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Furusawa

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(54) **IMAGE FORMING APPARATUS WITH MOVING FIRST AND SECOND REGULATING MEMBERS**

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(73) Assignee: **Canon Kabushiki Kaisha** (JP)

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(21) Appl. No.: **13/311,868**

(22) Filed: **Dec. 6, 2011**

(65) **Prior Publication Data**

US 2012/0074642 A1 Mar. 29, 2012

Related U.S. Application Data

(63) Continuation of application No. 12/473,976, filed on May 28, 2009, now Pat. No. 8,136,809.

(30) **Foreign Application Priority Data**

May 29, 2008 (JP) 2008-140493

(51) **Int. Cl.**
B65H 1/00 (2006.01)
B65H 1/04 (2006.01)

(52) **U.S. Cl.**
CPC ***B65H 1/04*** (2013.01)
USPC **271/171**

(58) **Field of Classification Search**
USPC 271/171
See application file for complete search history.

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(74) *Attorney, Agent, or Firm* — Rossi, Kimms & McDowell LLP

(57) **ABSTRACT**

A trailing end of a sheet stored in a cassette body is regulated by a first trailing end regulating member and a second trailing end regulating member. The first trailing end regulating member is provided to be slid in a cassette case where the sheet is stored, and the second trailing end regulating member is provided in the first trailing end regulating member to be slid. In addition, at positions according to a size of the sheet that is stored in the cassette case, the first trailing end regulating member is held by a first holding portion and the second trailing end regulating member is held by a second holding portion. In addition, holding of the first trailing end regulating member by the first holding portion and holding of the second trailing end regulating member by the second holding portion are released by the operation of a trailing end regulating lever.

5 Claims, 23 Drawing Sheets

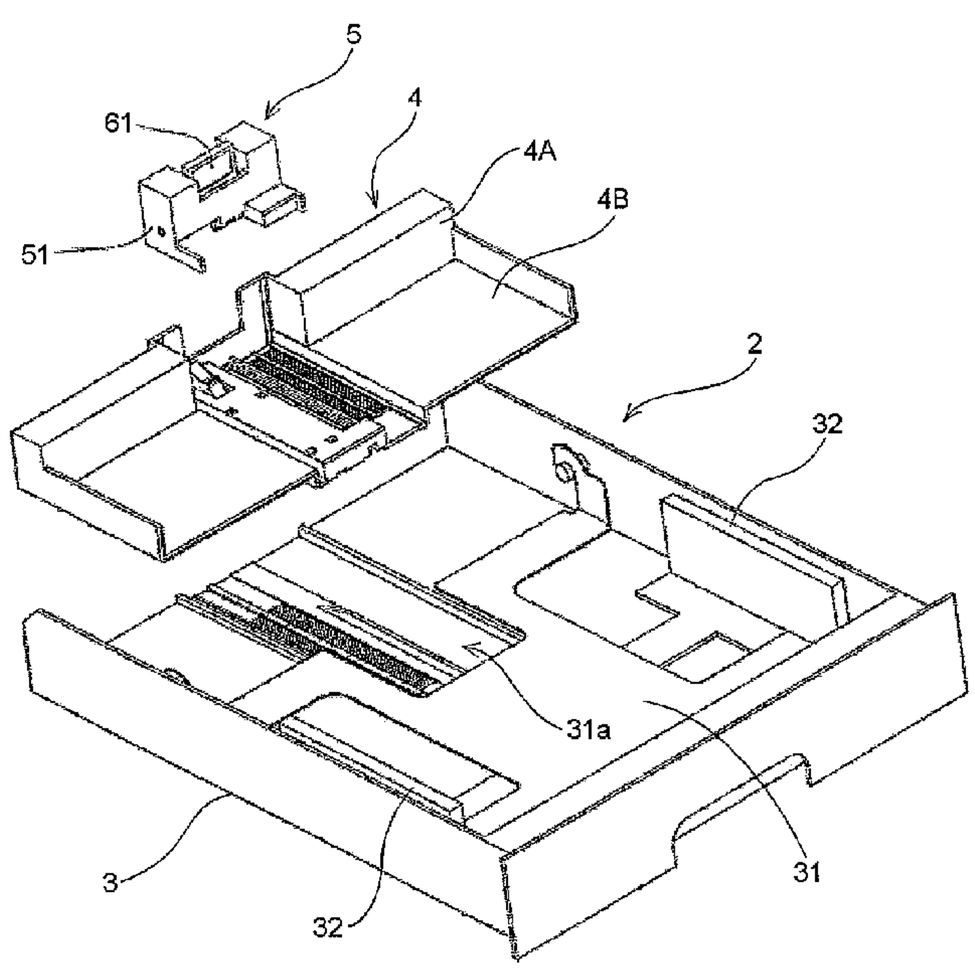

FIG. 1

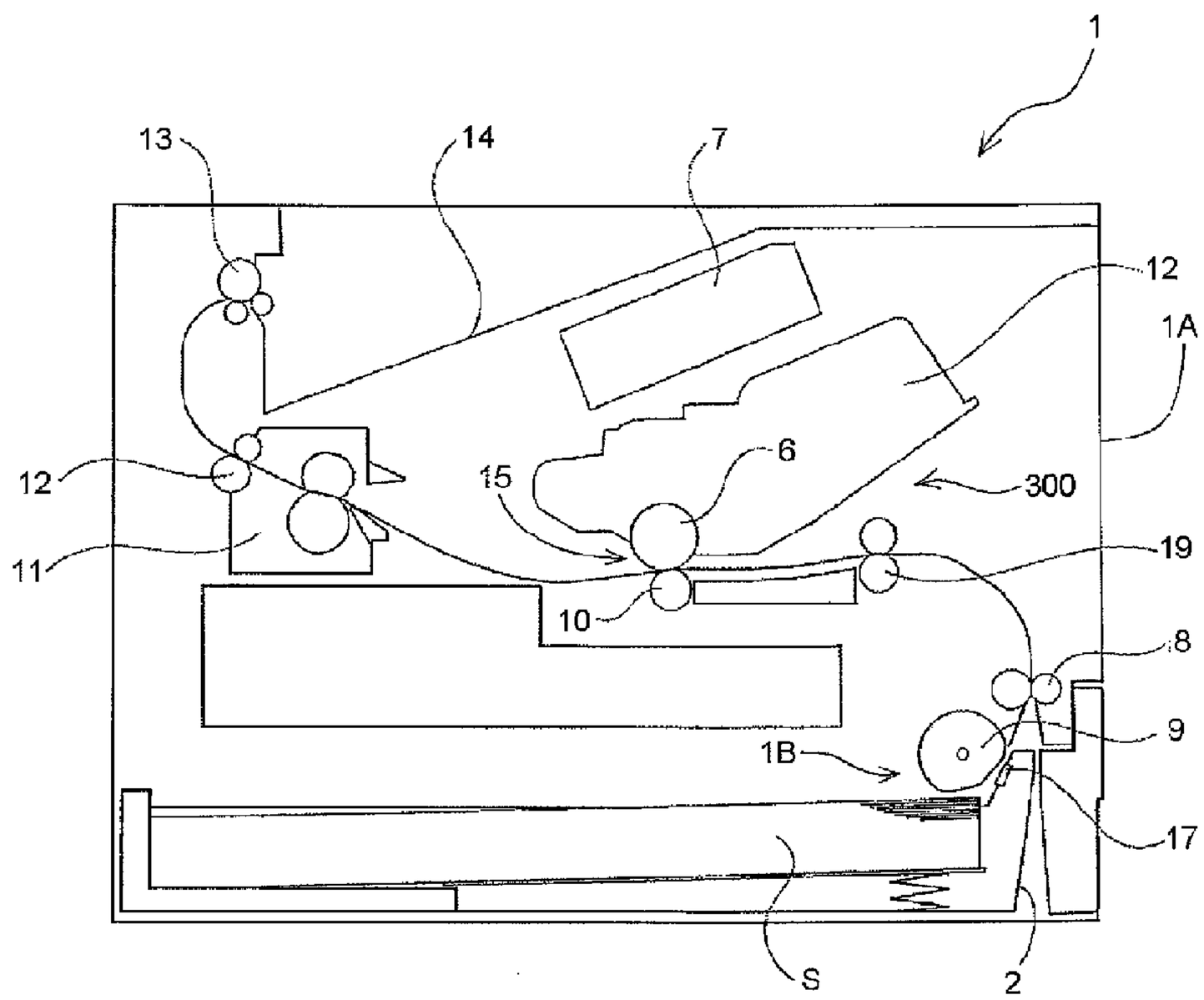

FIG. 2

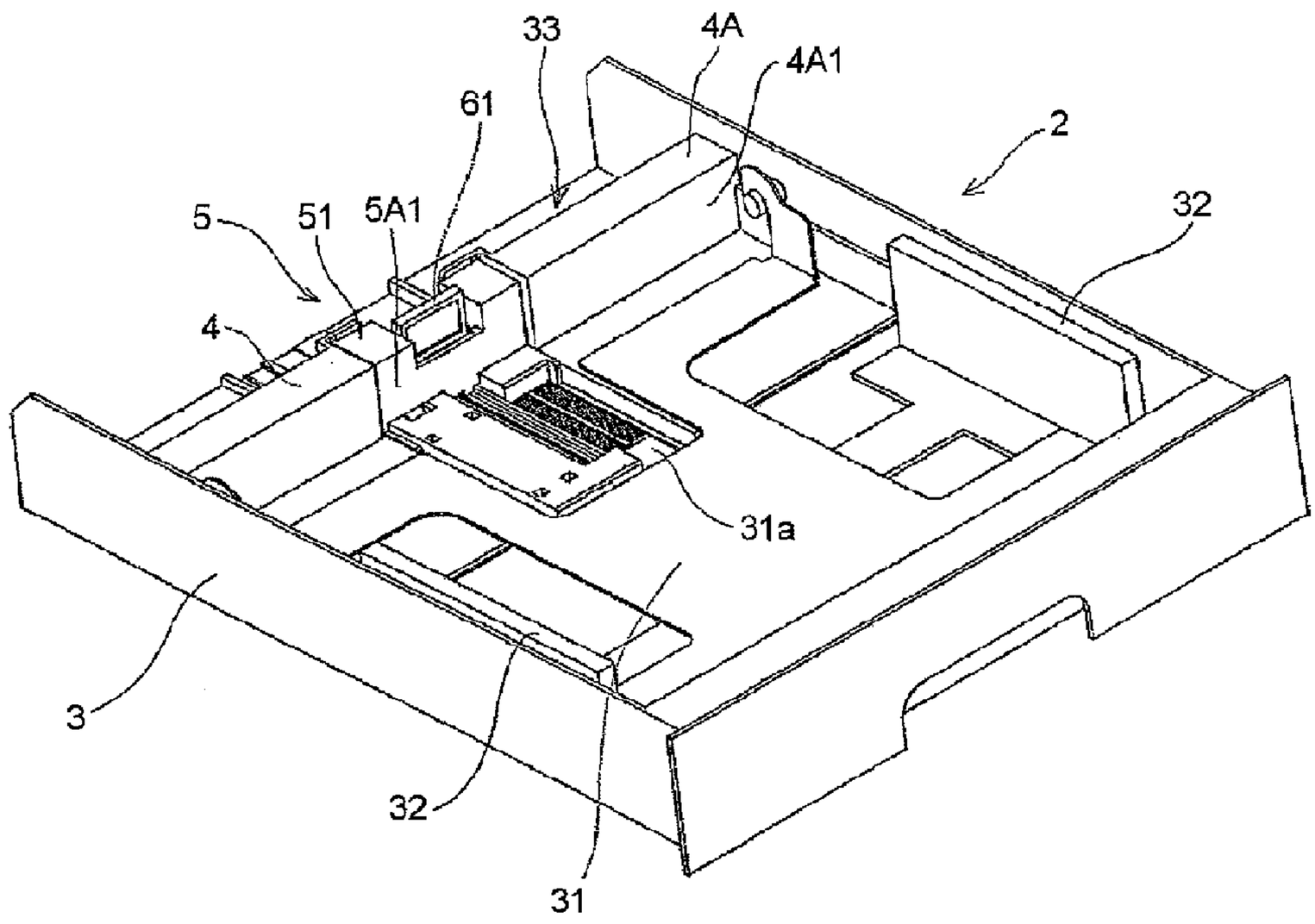

FIG. 3

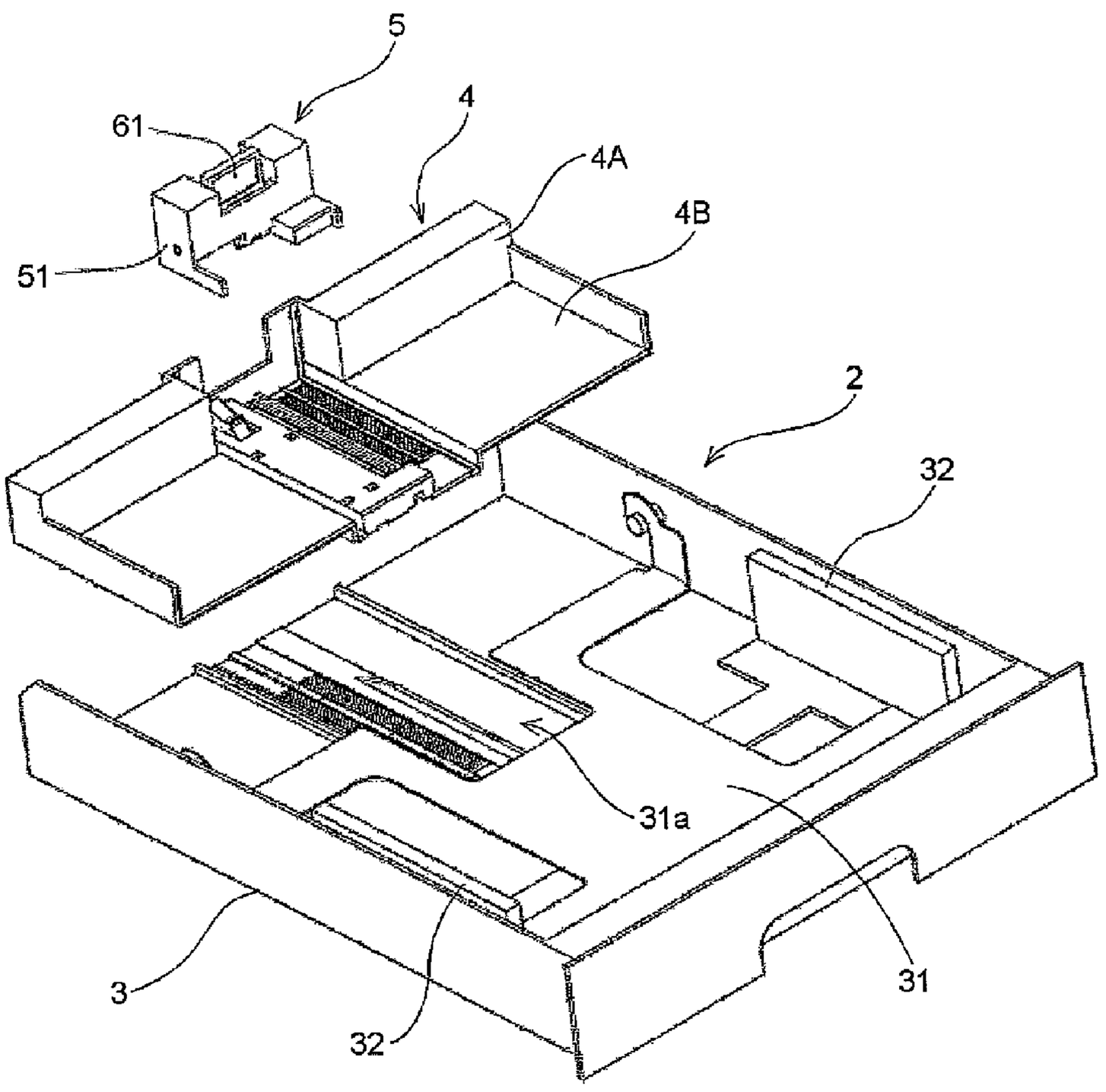

FIG. 4

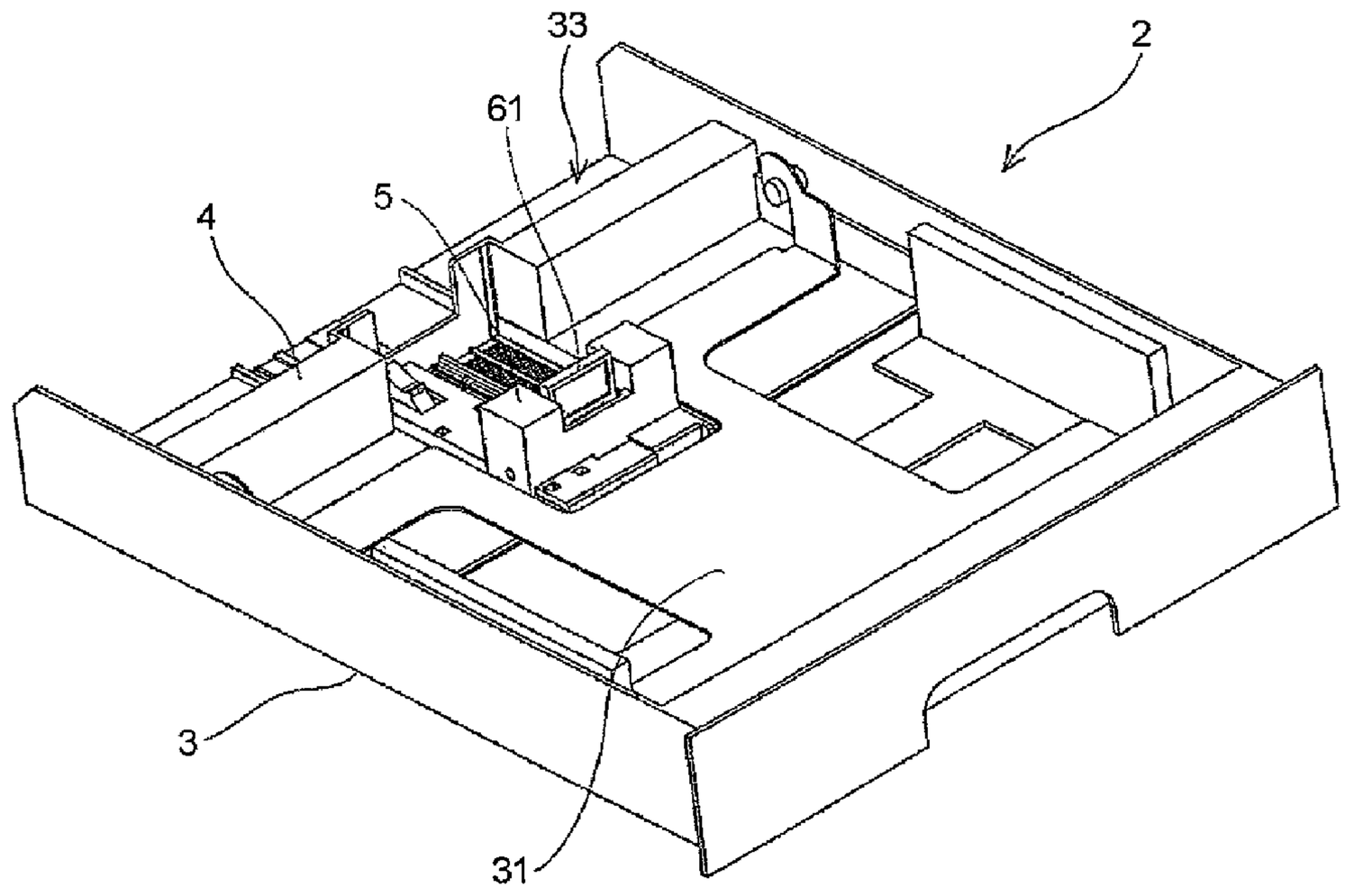

FIG. 5

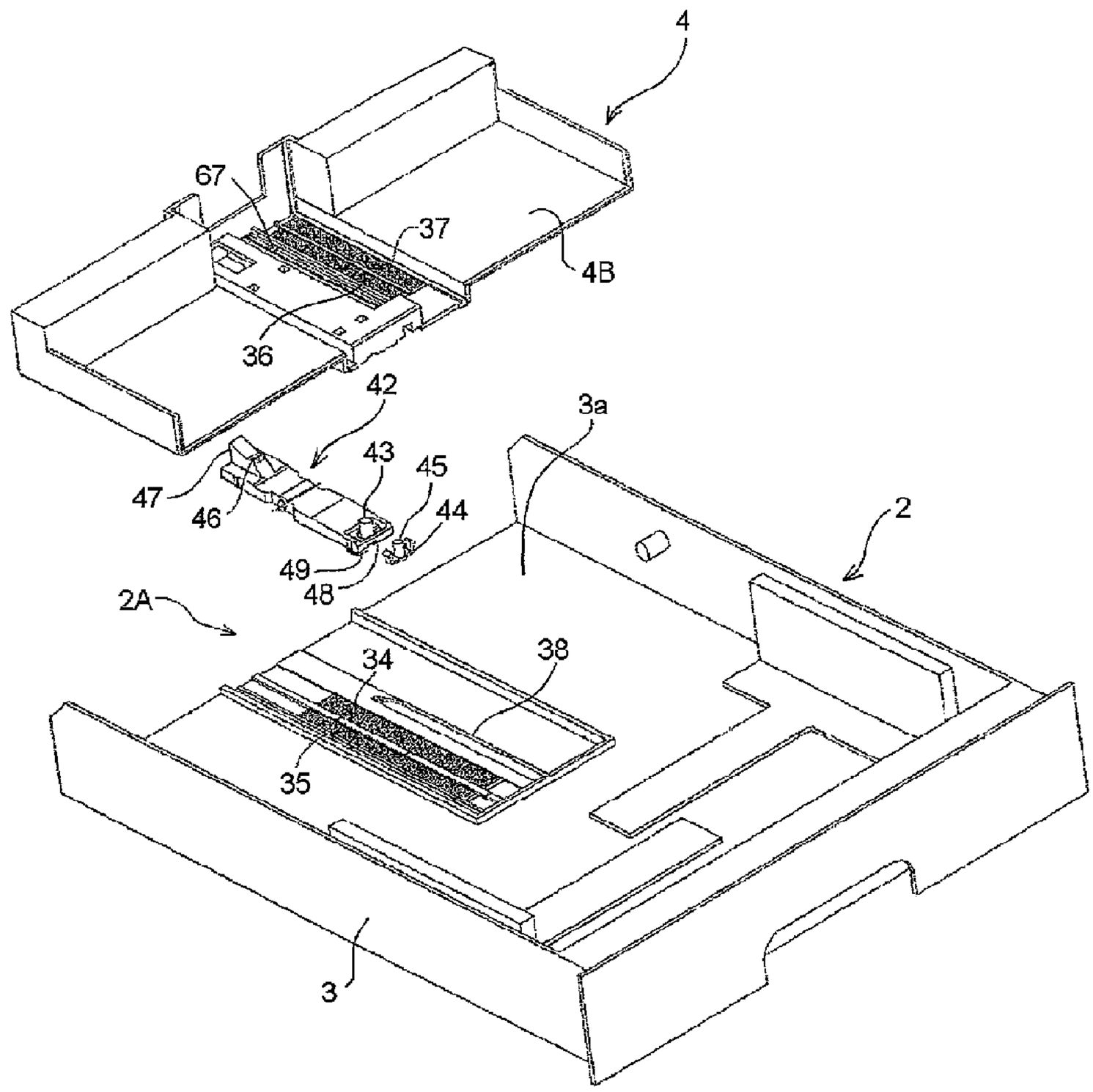

FIG. 6

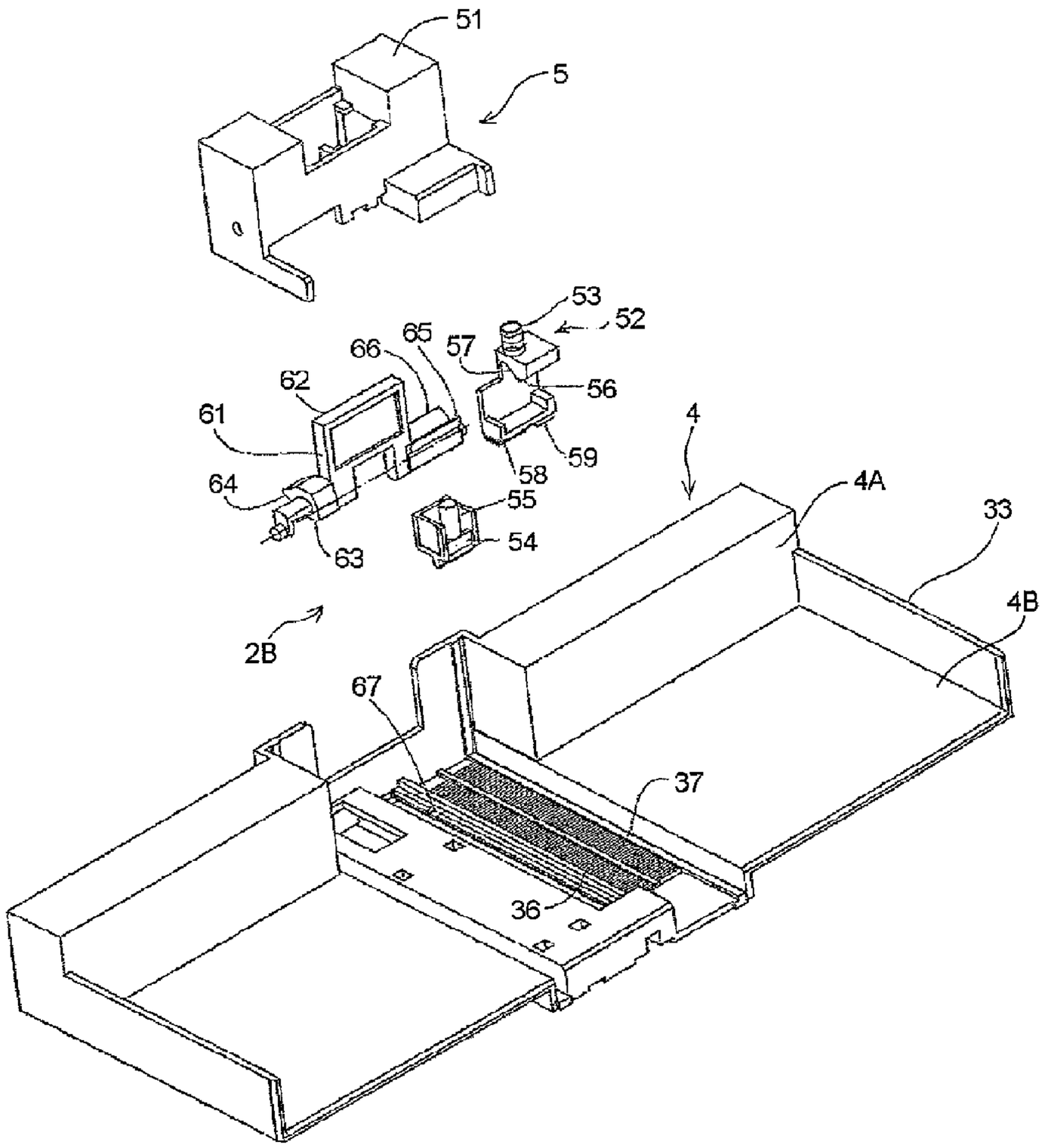

FIG. 7

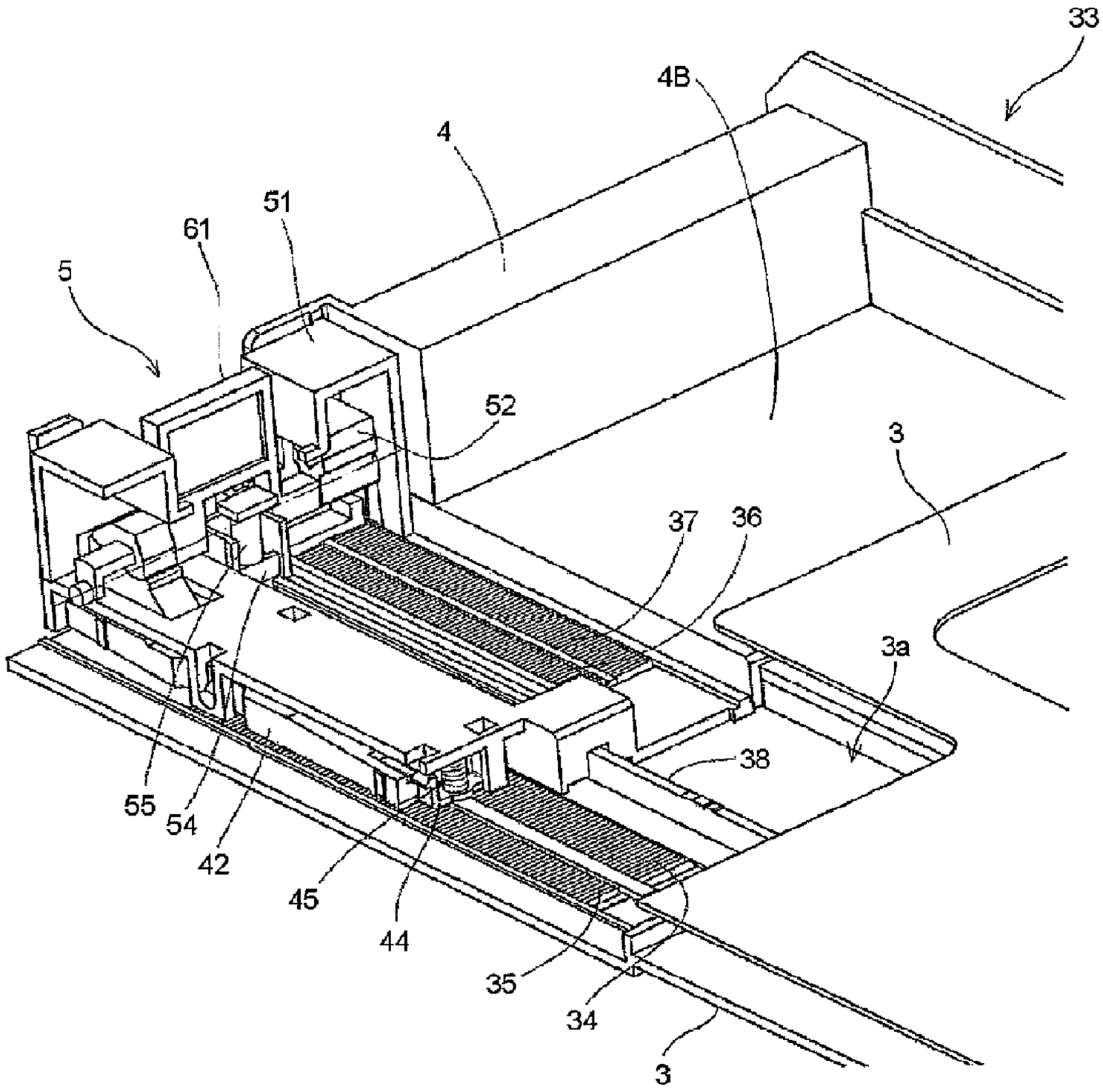

FIG. 8

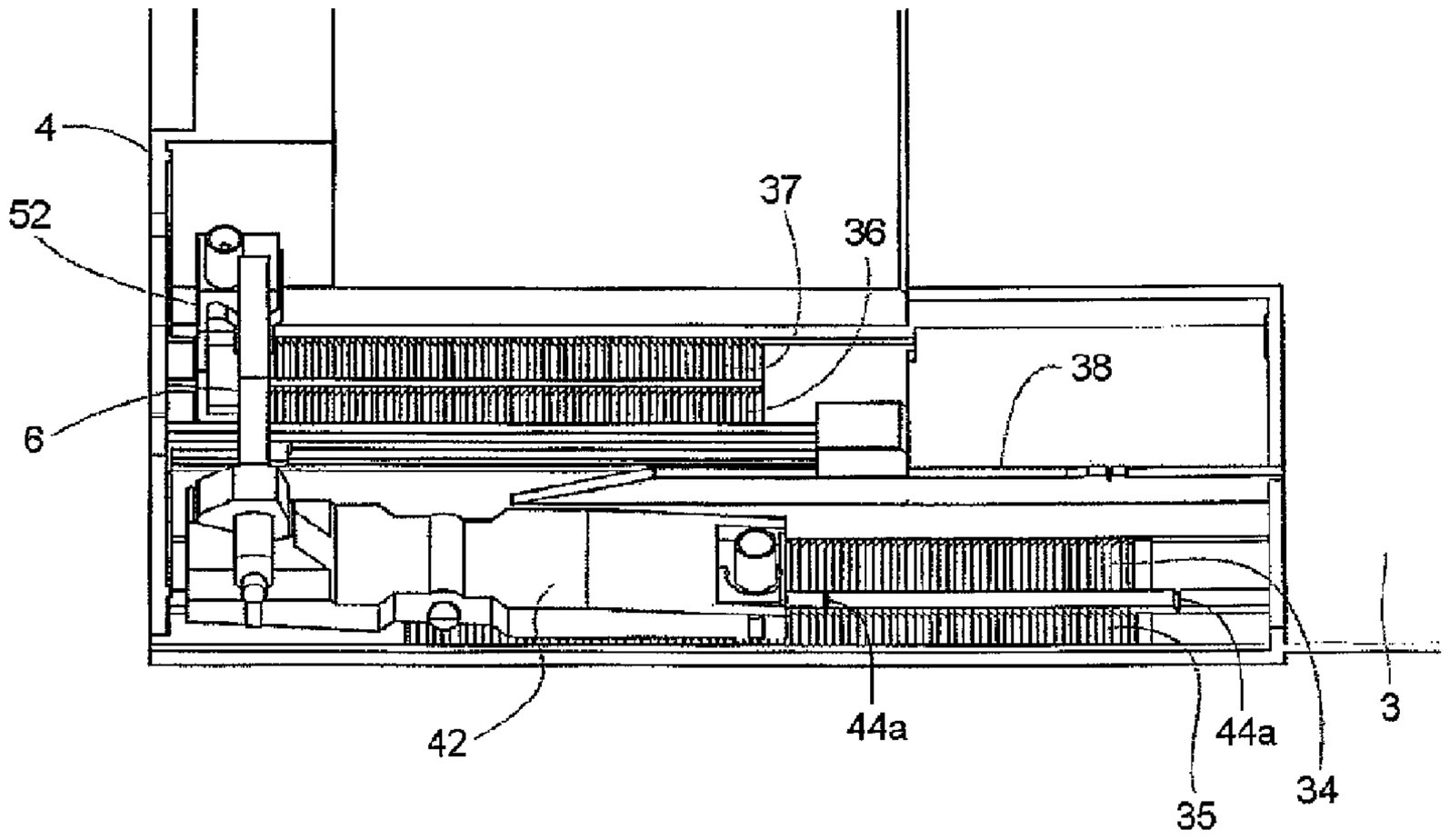

FIG. 9A

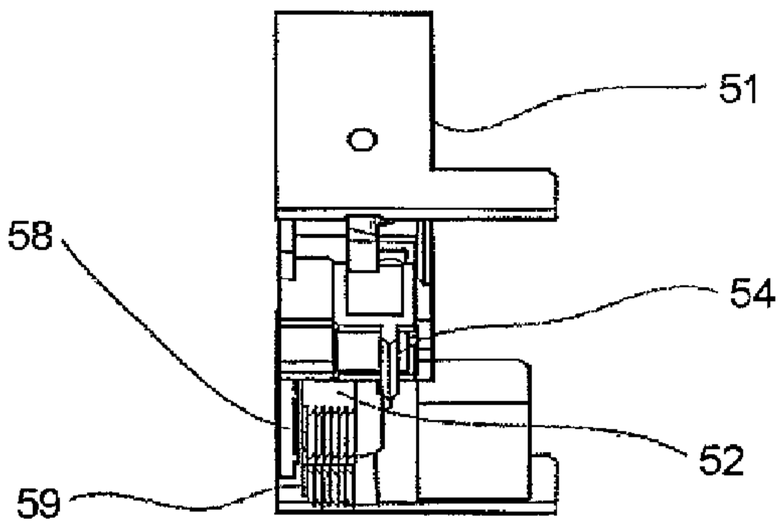

FIG. 9B

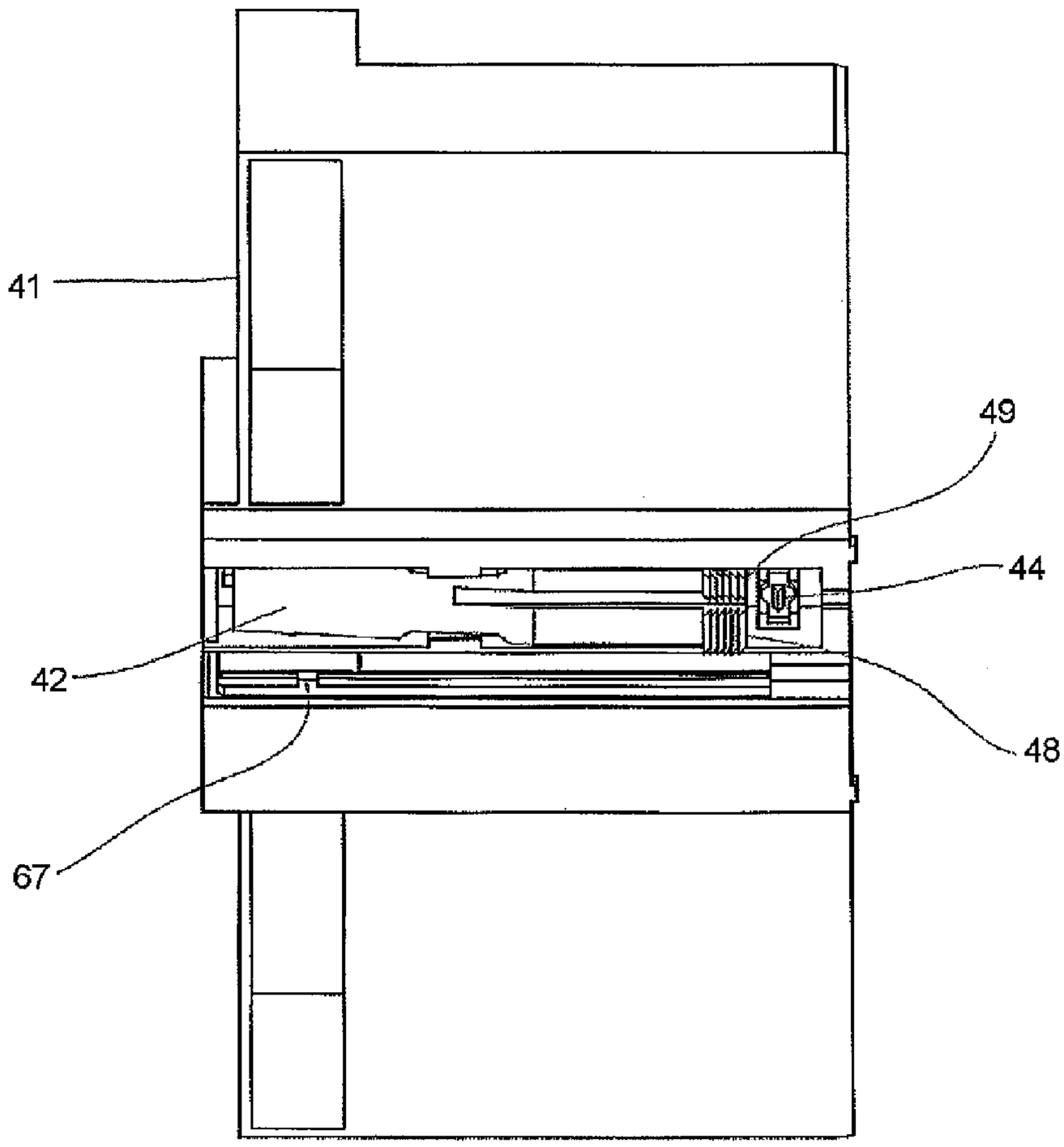

FIG. 10

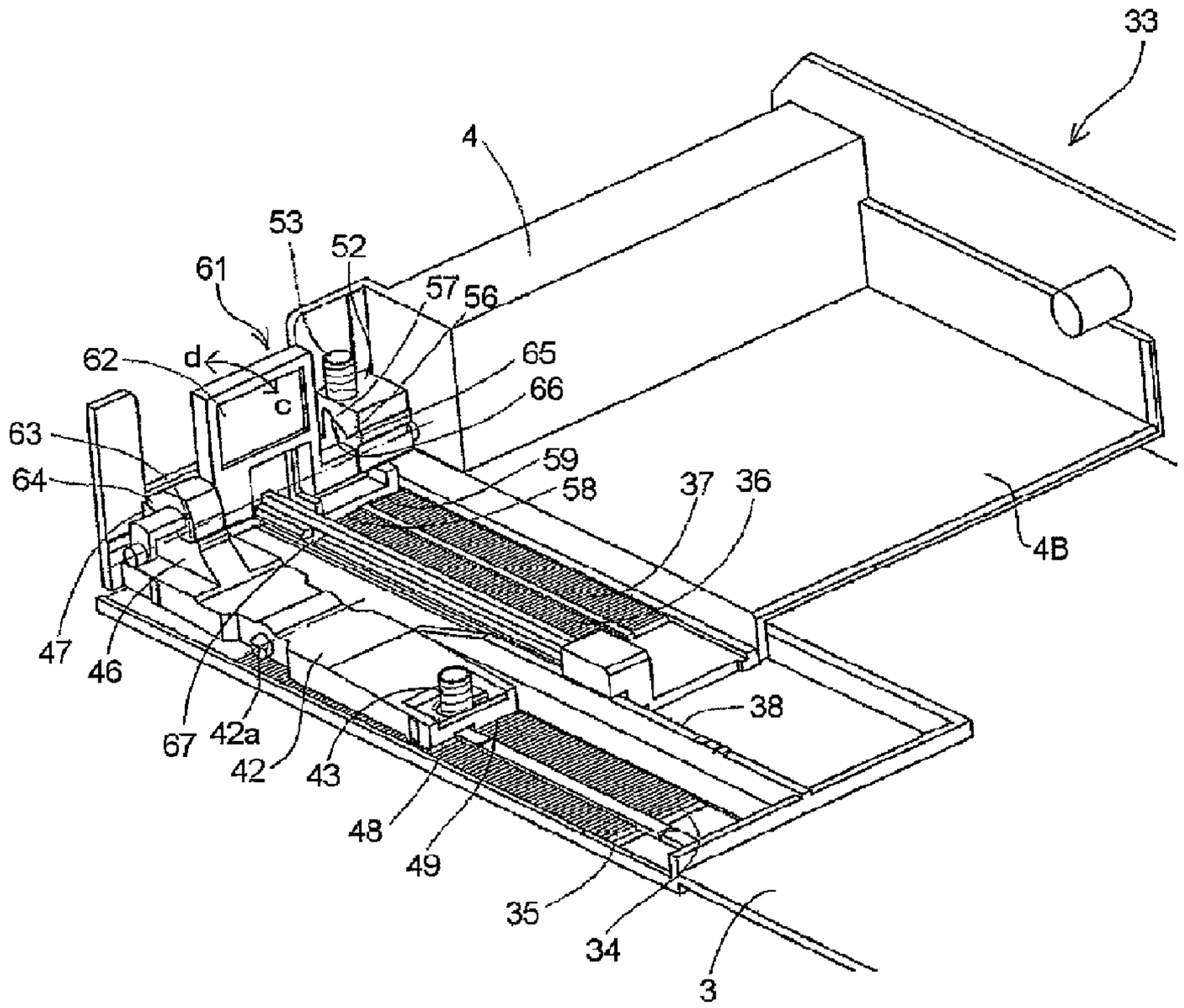
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FIG. 11

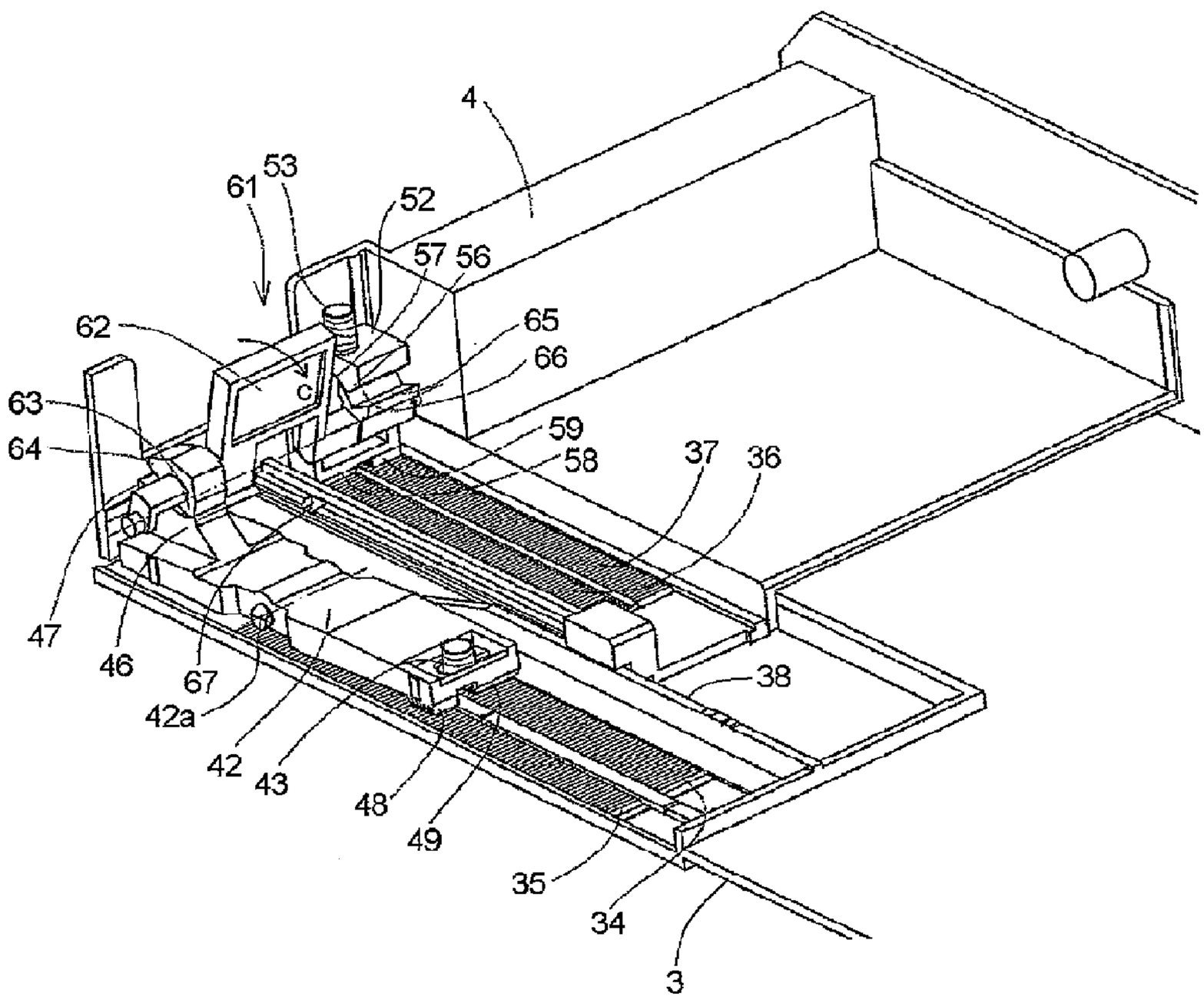
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FIG. 12

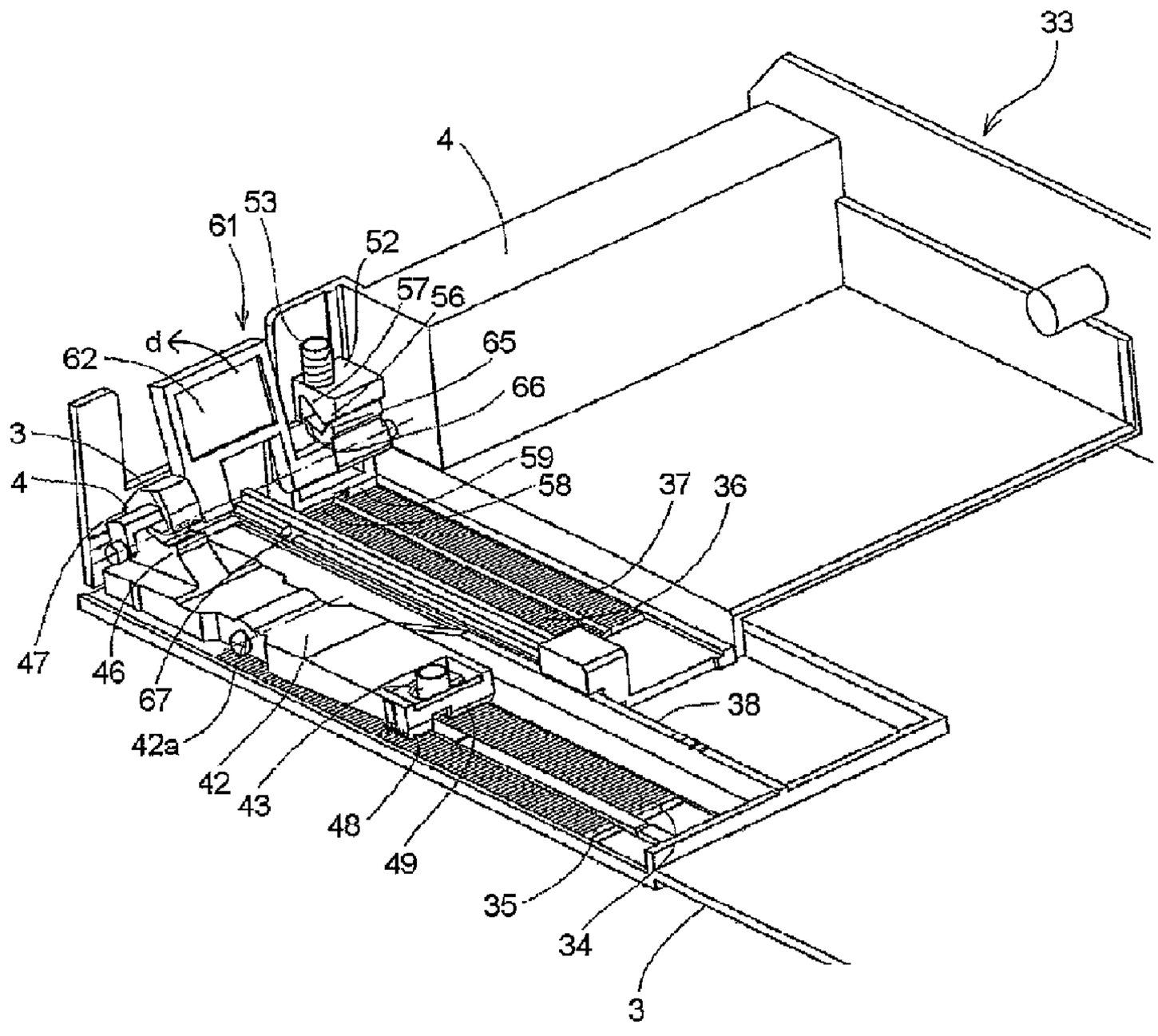
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FIG. 13A

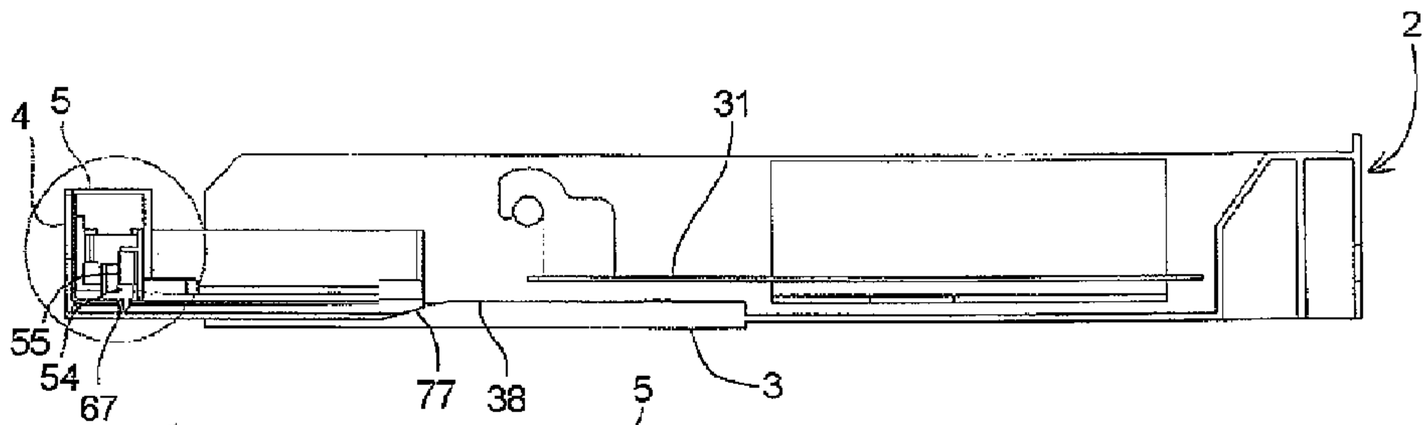

FIG. 13B

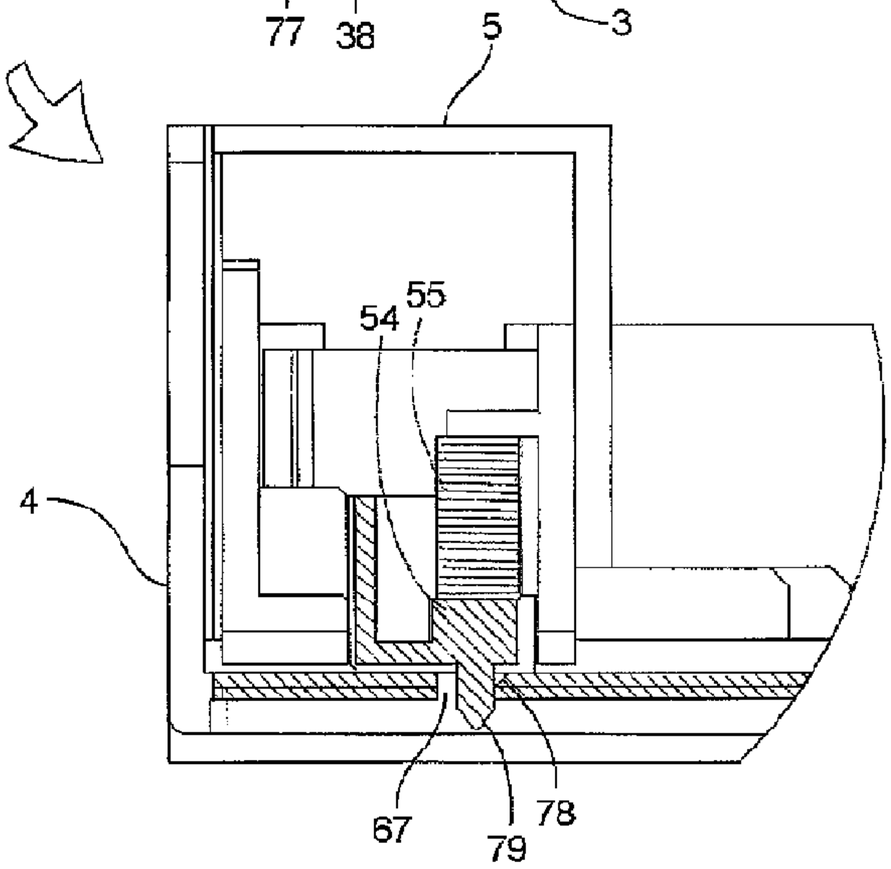

FIG. 14A

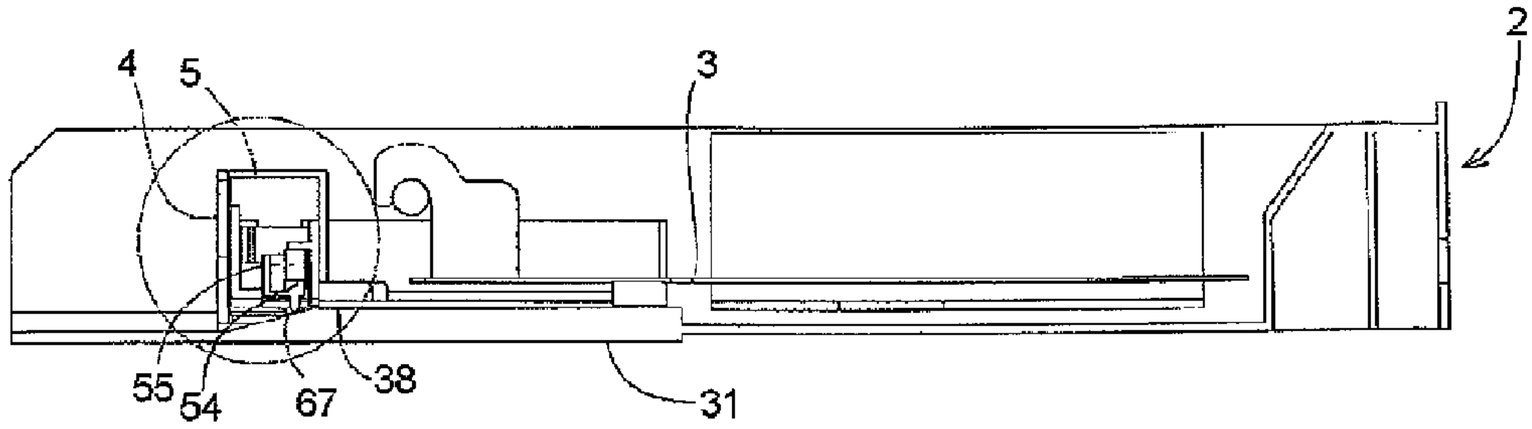

FIG. 14B

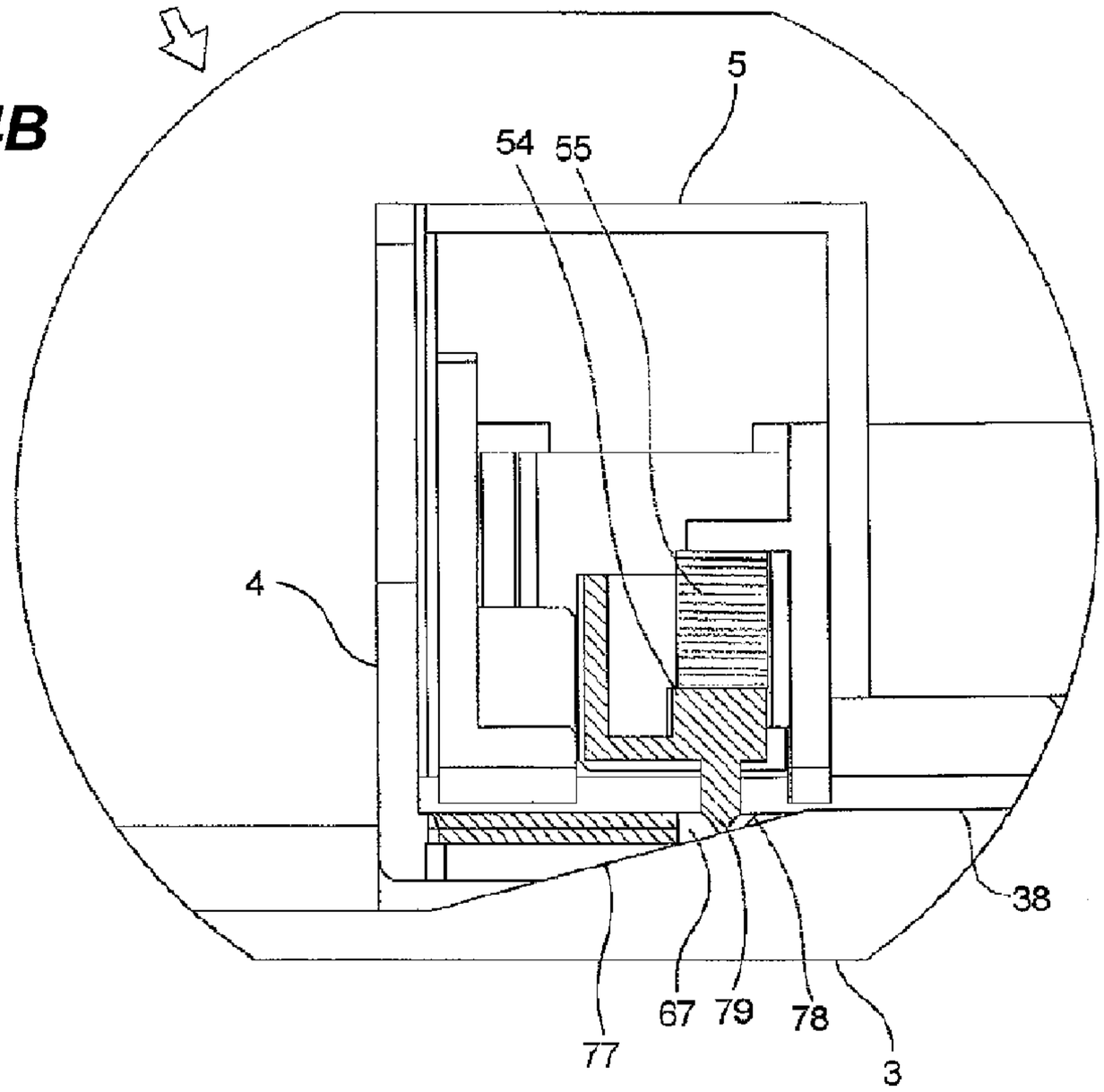

FIG. 15

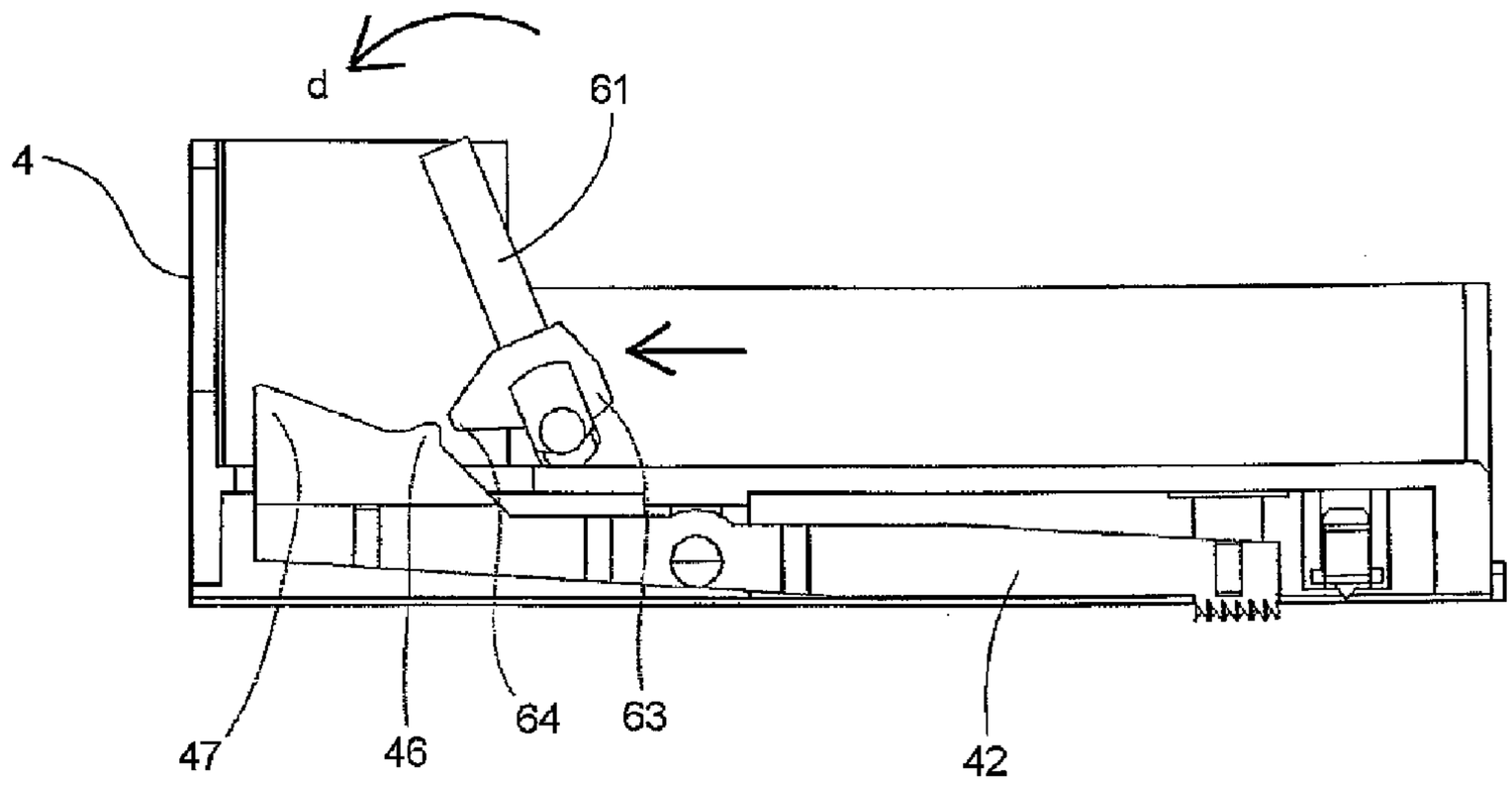

FIG. 16A

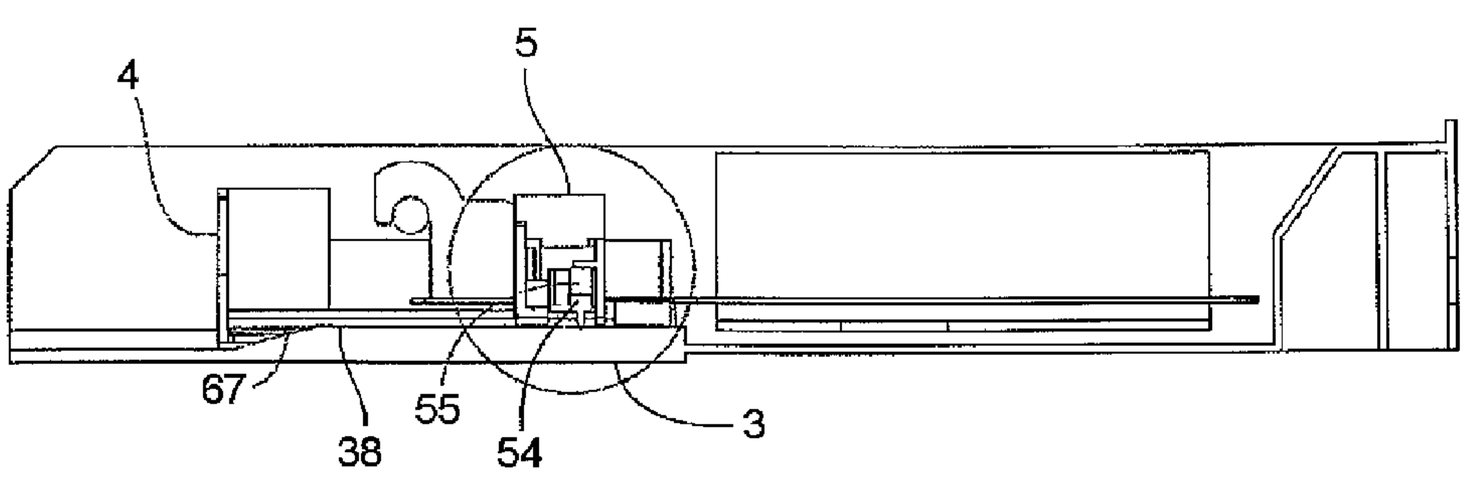

FIG. 16B

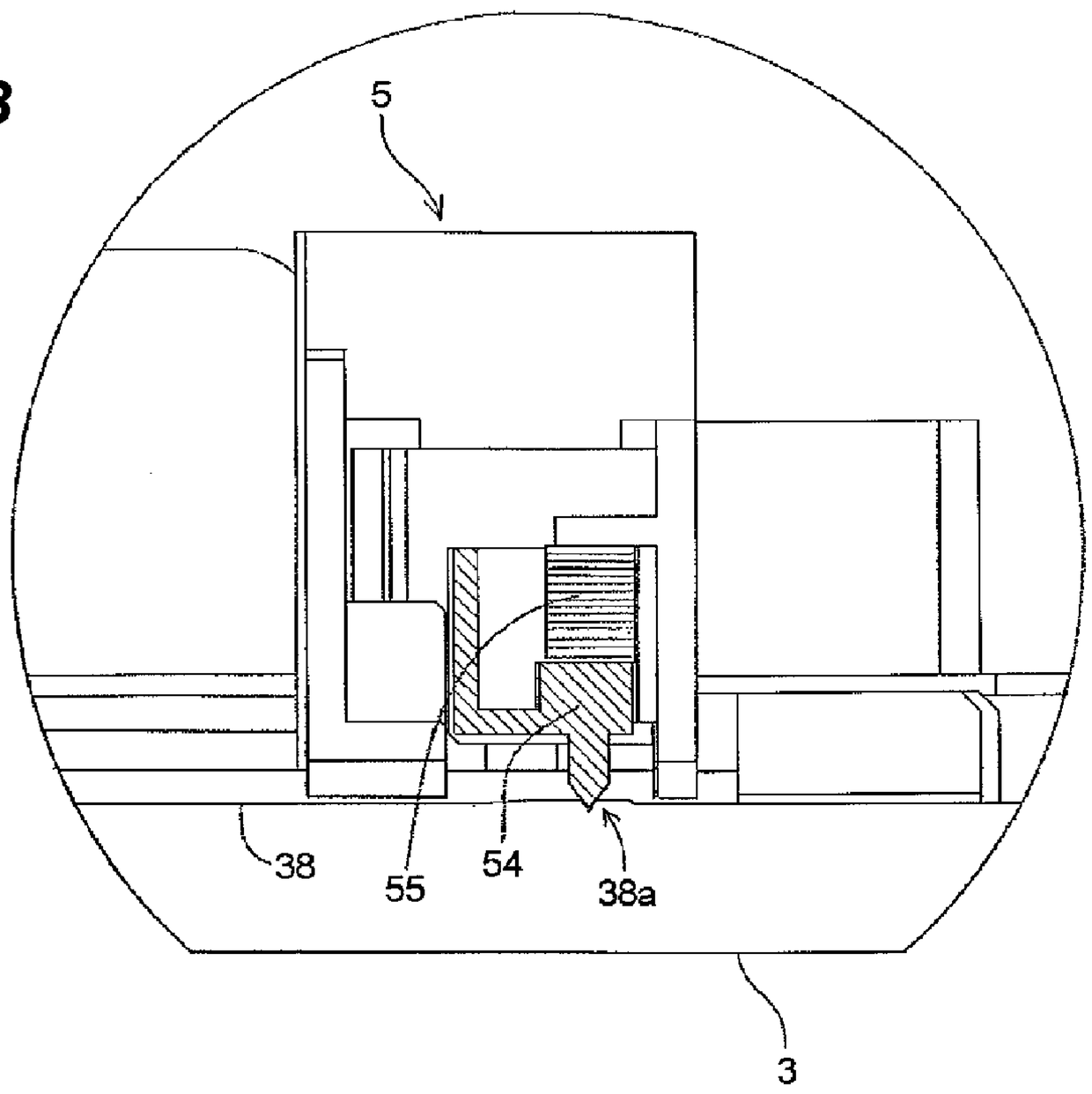

FIG. 17

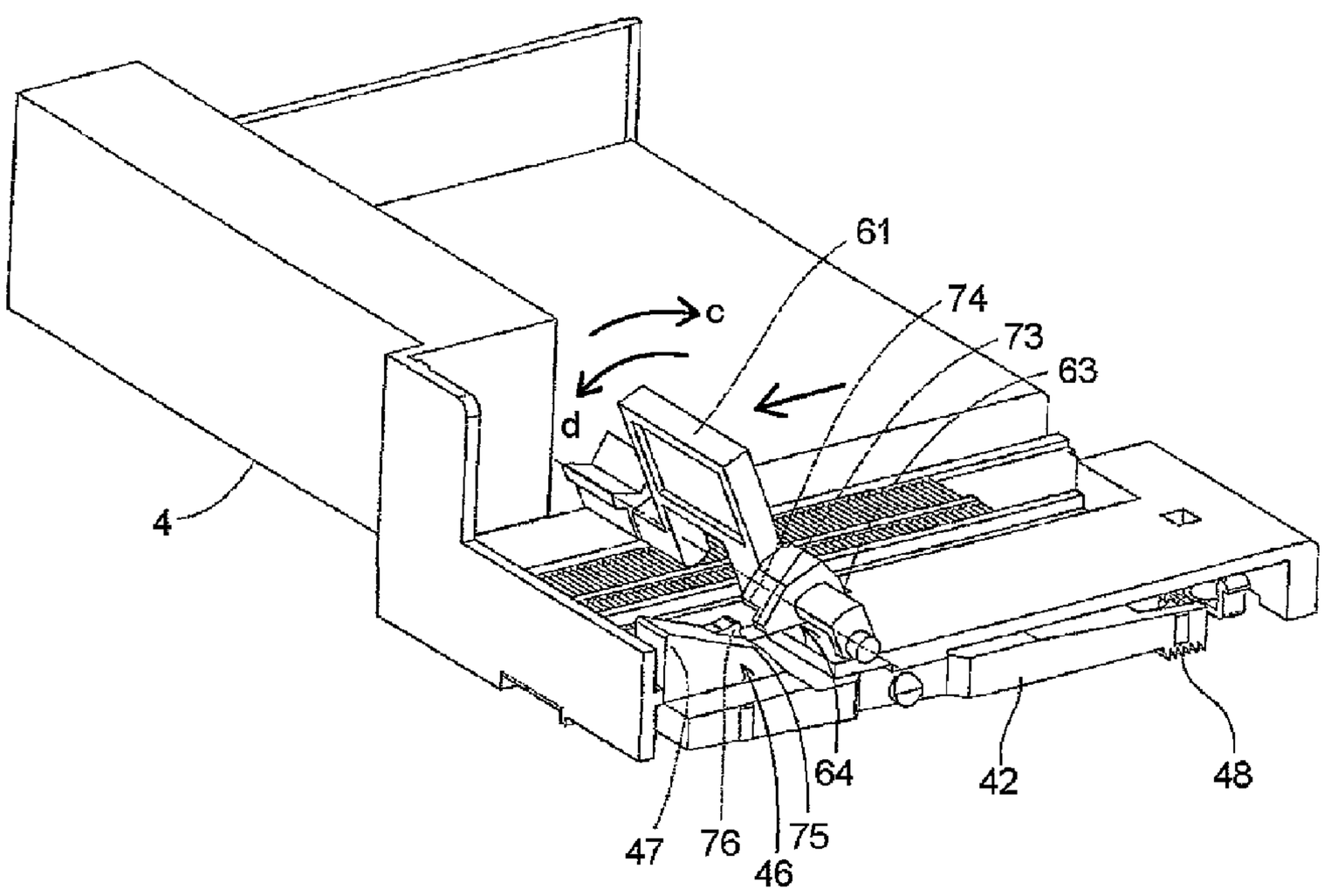

FIG. 18

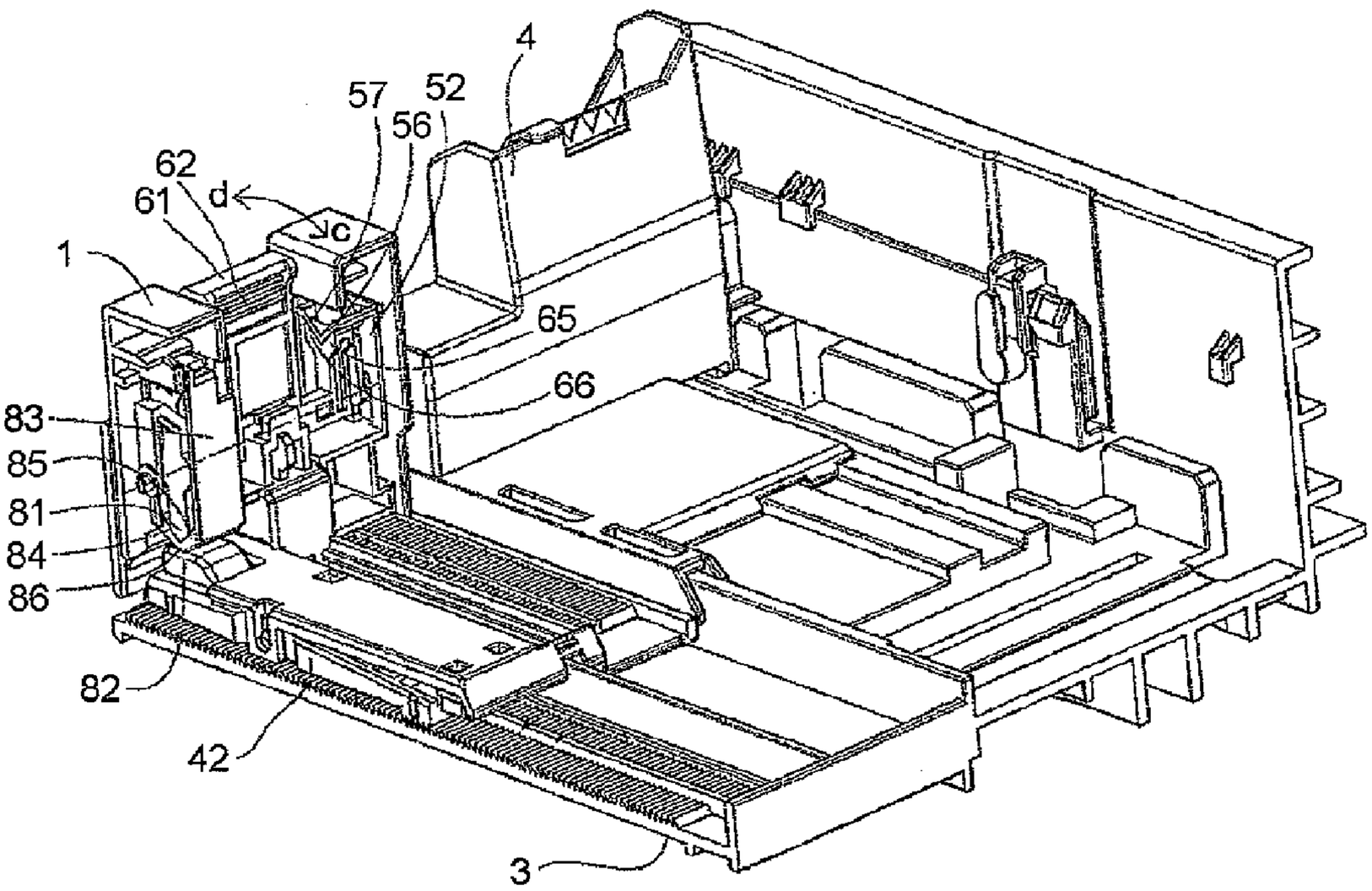

FIG. 19

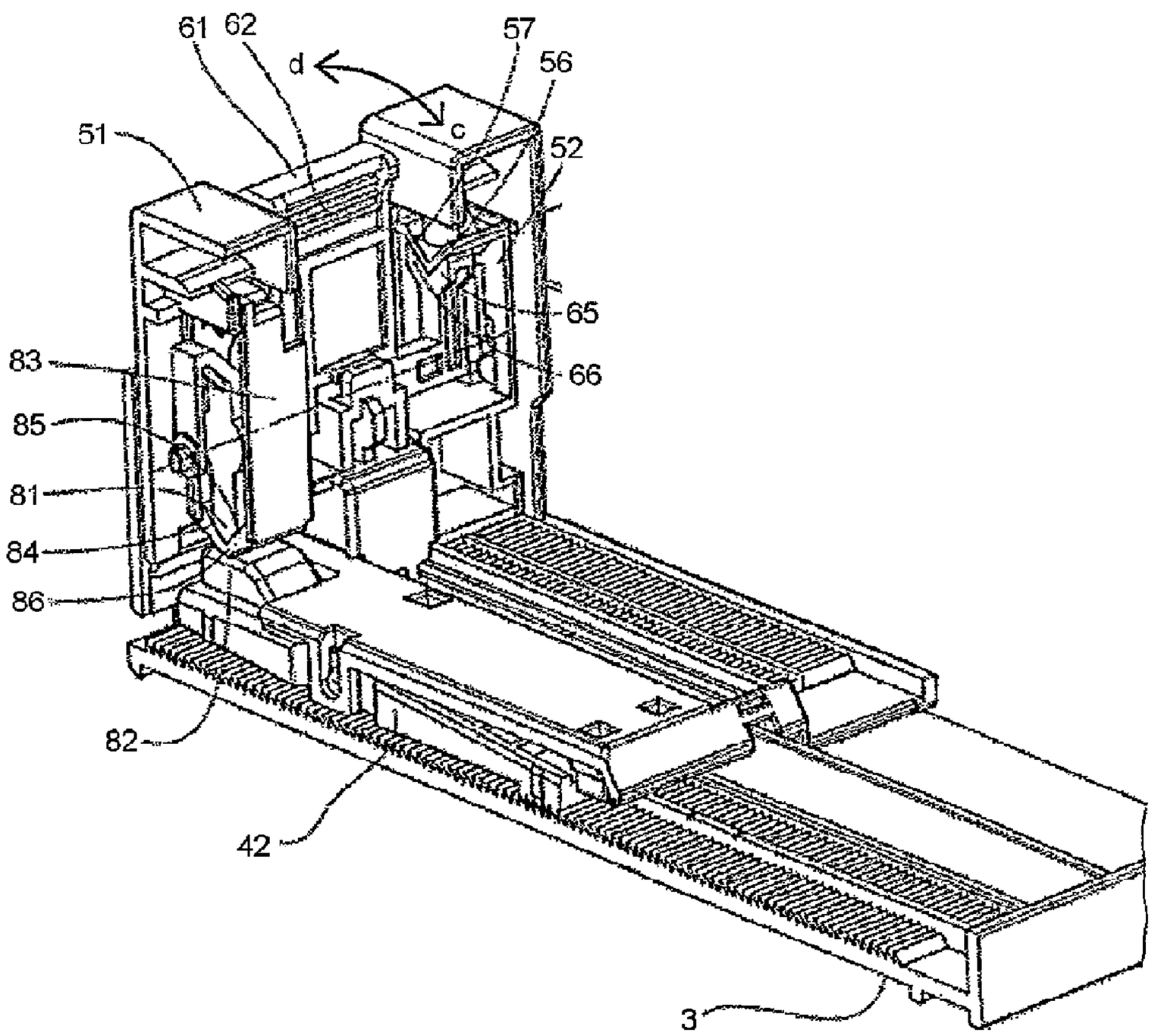

FIG. 20

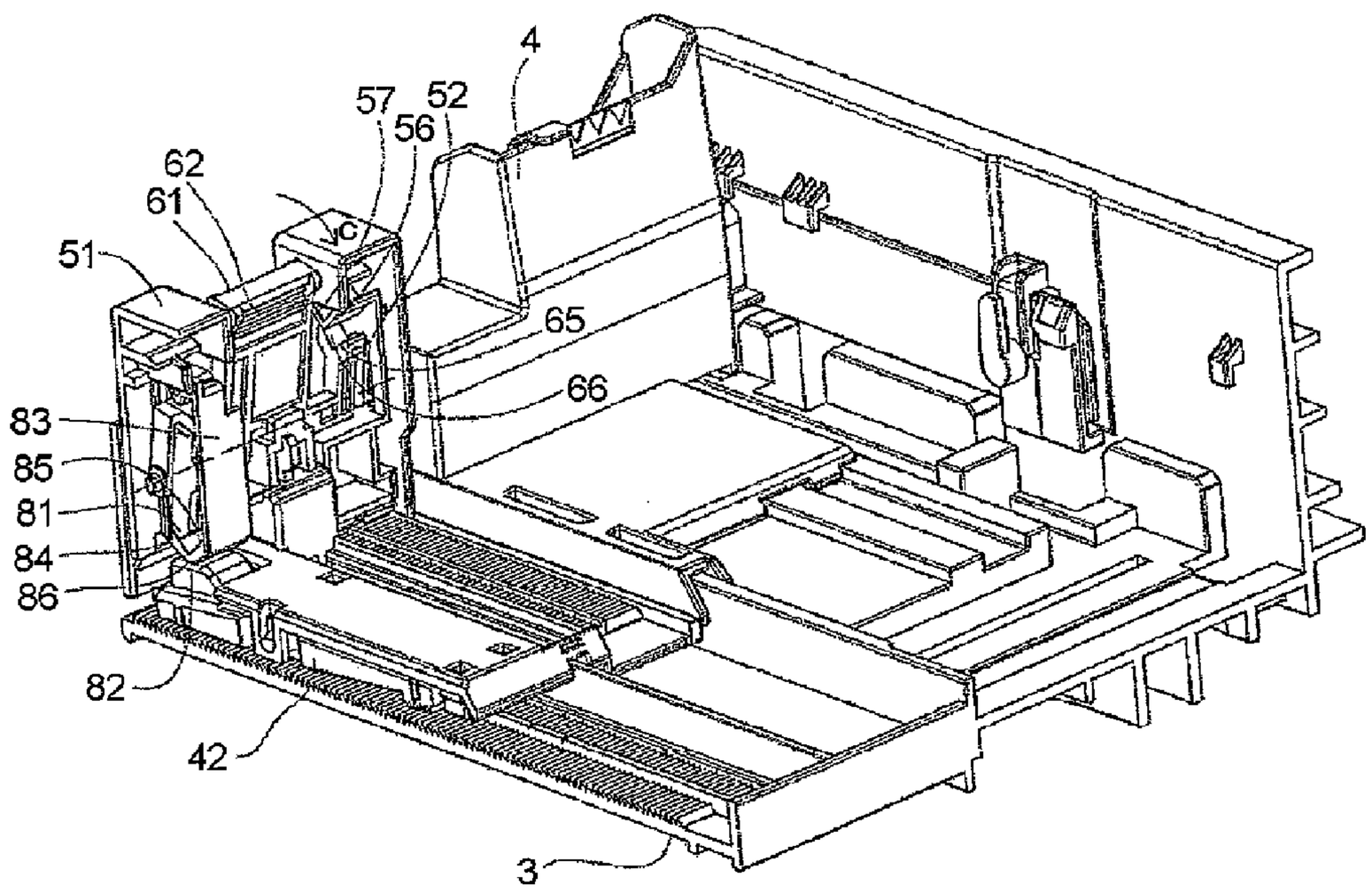

FIG. 21

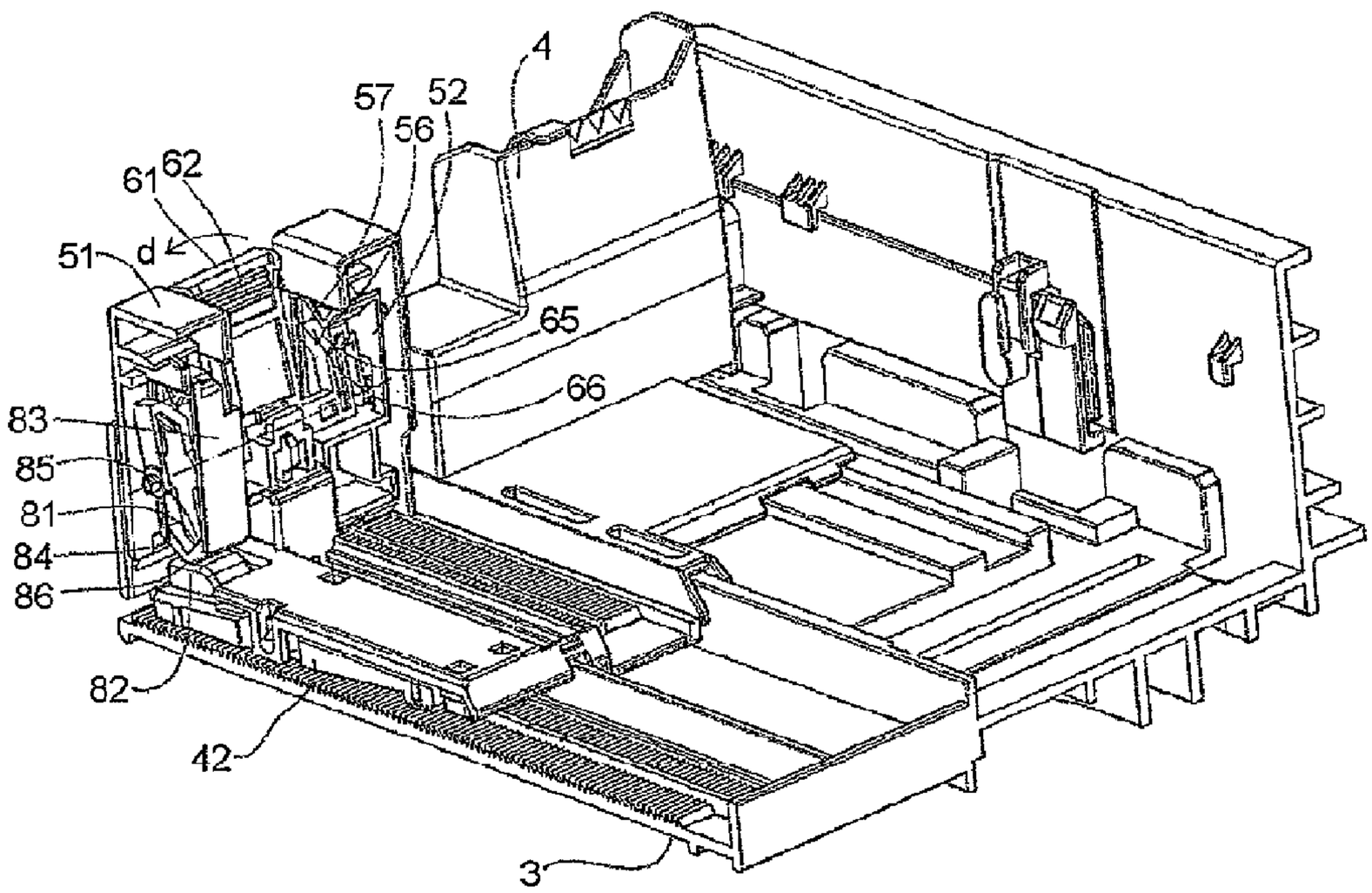

FIG. 22

PRIOR ART

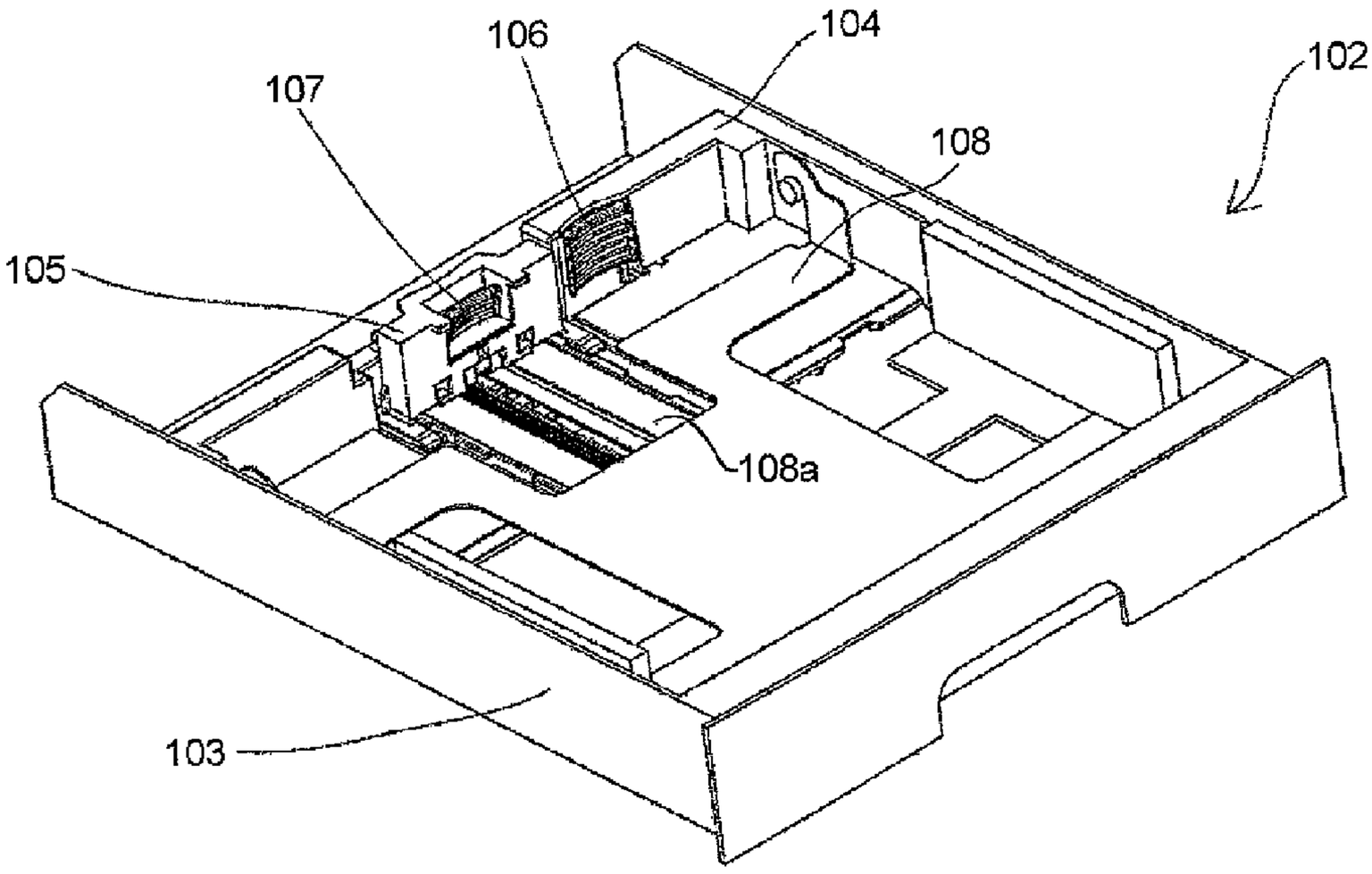

FIG. 23A

PRIOR ART

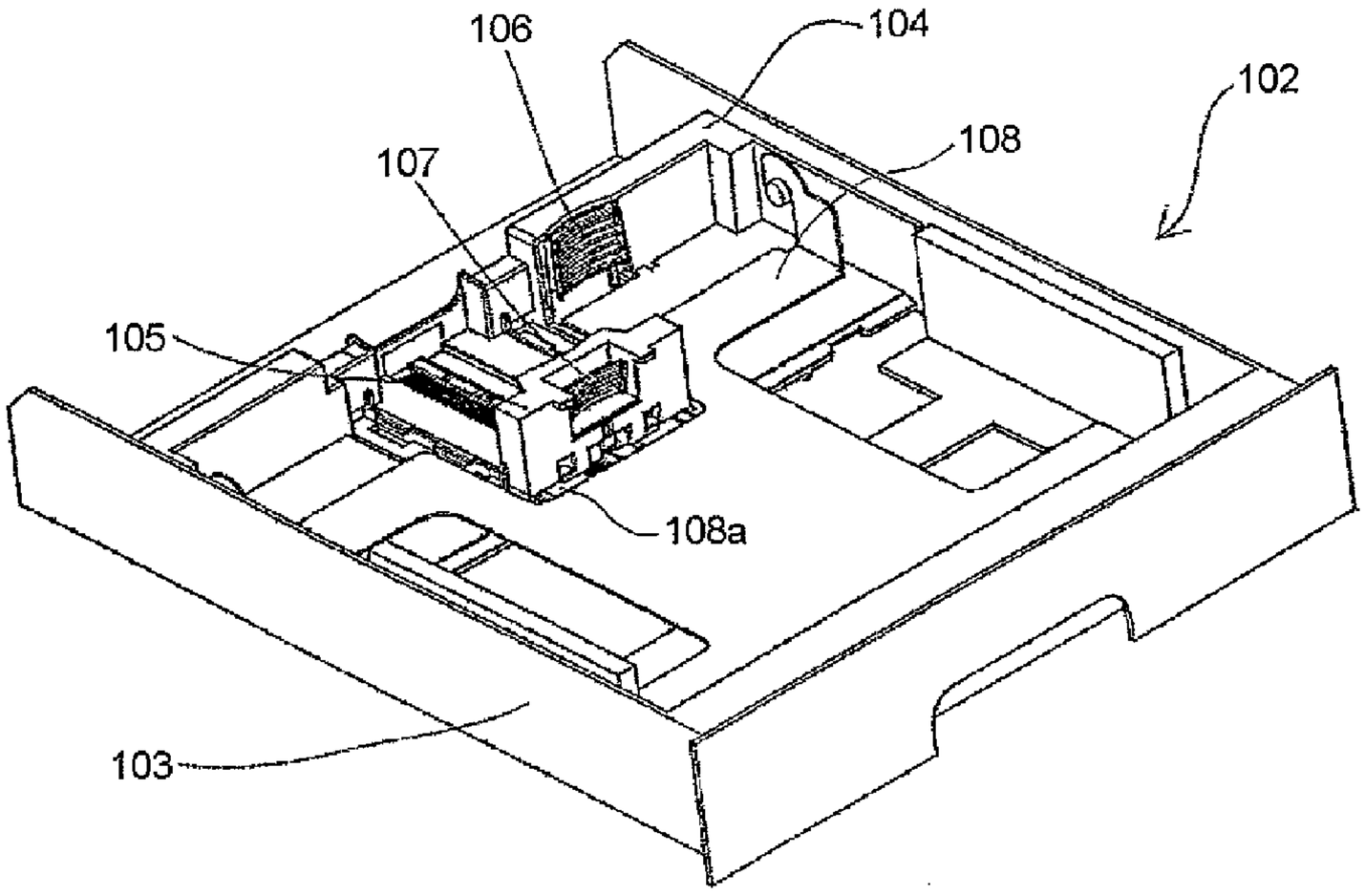

FIG. 23B

PRIOR ART

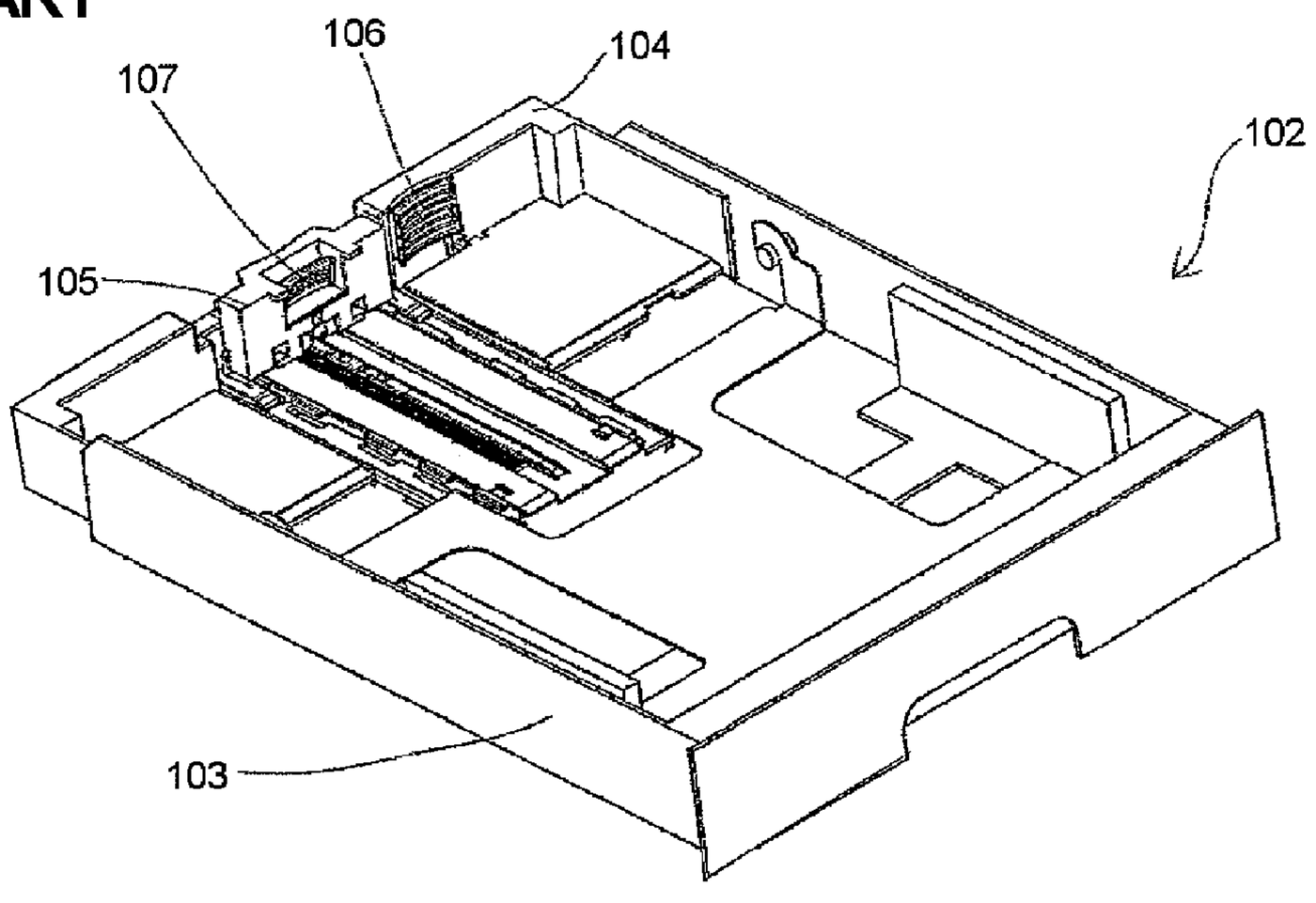

IMAGE FORMING APPARATUS WITH MOVING FIRST AND SECOND REGULATING MEMBERS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of and claims benefit to U.S. patent application Ser. No. 12/473,976, filed May 28, 2009, the entire content of which is hereby incorporated herein by reference. This application and the '976 application claim priority to JP Application No. 2008-140493, filed May 29, 2008.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming apparatus, and more particularly, to an image forming apparatus that provides a trailing end regulating member to be separated from a cassette body of a sheet cassette that stores sheets.

2. Description of the Related Art

In general, each of image forming apparatuses, such as a copying machine, a printer, and a facsimile, includes a sheet feeding apparatus. In this image forming apparatus, a sheet is fed from the sheet feeding apparatus to an image forming portion and an image is formed on the sheet by the image forming portion. The sheet feeding apparatus is generally configured as follows. A sheet cassette serving as a sheet storage portion is mounted in an image forming apparatus body to be drawn therefrom, and sheets stored in the sheet cassette is automatically fed to the image forming portion by a sheet feeding roller.

In this case, a cassette body where sheets of the sheet cassette are stored is provided with a trailing end regulating member. When a sheet that has a smaller size than a sheet having a maximum size where the sheet can be stored is stored, the trailing end regulating member regulates a position of an end of the stored sheet at an upstream side of a sheet feeding direction (hereinafter, simply referred to as a trailing end). Further, the sheet cassette body is provided with a side end regulating member that regulates a position of a side end of the sheet in a direction orthogonal to the sheet feeding direction (hereinafter, referred to as width-wise direction).

In addition, in the sheet cassette, the position of the side end of the sheet is regulated by the side end regulating member. Meanwhile, the trailing end of the sheet is regulated by the trailing end regulating member, such that a position of the tip of the sheet is always regulated to a predetermined sheet feedable position. As a result, when the sheet cassette is mounted in the image forming apparatus body, each sheet can be stably fed without depending on the size of each sheet.

In recent years, in order to improve spatial efficiency, the image forming apparatus has been miniaturized. However, when the image forming apparatus is miniaturized, due to the used sheet, that is, the sheet cassette, the image forming apparatus body may be shortened. In this case, if the sheet cassette is mounted in the image forming apparatus body, the sheet cassette may protrude from the image forming apparatus body, which results in deteriorating spatial efficiency.

Accordingly, in order to resolve the above-described problem, for example, Japanese Patent Application Laid-Open No. 2001-97561 discloses an expanding/contracting sheet cassette in which a trailing end regulating member is provided to be drawn from a cassette body and drawn in accordance with a size of a sheet.

In this case, in the expanding/contracting sheet cassette, the cassette body is formed to have a size smaller than or equal to a size of the image forming apparatus body. In addition, when a sheet that has a size larger than the size of the cassette body is stored, the trailing end regulating member is drawn by the amount of protrusion of the sheet from the image forming apparatus body.

In the sheet cassette according to the related art that has the above-described structure, the trailing end regulating member is locked by a locking member at the drawn position or a storage position. When the trailing end regulating member is drawn or the sheet is stored, locking of the locking member is released.

Further, in order to store a sheet having a small size in the sheet cassette, the trailing end regulating member is divided into two parts. That is, one of the two parts is used as a trailing end regulating member for a large size and the other is used as a trailing end regulating member for a small size. Further, the cassette body is provided with a middle plate needed to press the sheet by the sheet feeding roller. However, in the middle plate, a slit is provided to enable a movement of the trailing end regulating member for the small size. In addition, the trailing end regulating member for the small size is provided to have a size smaller than a size of the trailing end regulating member for the large size, such that the trailing end regulating member of the small size can move in the slit.

FIG. **22** is a perspective view illustrating an expanding/contracting sheet cassette according to the related art. In FIG. **22**, an expanding/contracting sheet cassette **102**, a cassette body **103**, and a first trailing end regulating member **104** are illustrated. In this case, the first trailing end regulating member **104** is provided in the cassette body **103** to be slid. The first trailing end regulating member **104** includes a locking member (not illustrated) that locks the first trailing end regulating member **104** to the cassette body **103**, and a locking releasing lever **106** that releases locking by the locking member and is used for the first trailing end regulating member.

A second trailing end regulating member **105** for a small size is provided in the first trailing end regulating member **104** to be slid. The second trailing end regulating member **105** includes a locking member (not illustrated) that locks the second trailing end regulating member **105** to the cassette body **103** and a locking releasing lever **107** that releases locking by the locking member and is used for the second trailing end regulating member. A middle plate **108** is provided in the cassette body **103** to rotate in an upward-to-downward direction. The middle plate **108** is provided with a slit **108***a* where the second trailing end regulating member **105** enters.

In addition, when the sheet is stored in the sheet cassette **102**, locking of the first and second trailing end regulating members **104** and **105** are released by the locking releasing levers **106** and **107**, and the first and second trailing end regulating members **104** and **105** are moved to positions according to the size of the sheet.

For example, when a sheet having a small size is stored, only the second trailing end regulating member **105** enters into a slit that is formed in the middle plate **108**, as illustrated in FIG. **23**A. Further, when a sheet having a large size is stored, the first and second trailing end regulating members **104** and **105** are drawn from the cassette body **103**, as illustrated in FIG. **23**B.

However, in the image forming apparatus according to the related art that includes the sheet cassette, works for moving the two trailing end regulating members **104** and **105** are independently performed. For this reason, when a sheet that has a size different from the size of the sheets stored until now

is stored in the sheet cassette, it is needed to operate both the first trailing end regulating member **104** and the second trailing end regulating member **105** after releasing locking.

That is, in the sheet cassette according to the related art, when the size of the sheet is changed, a user needs to operate the two locking releasing levers **106** and **107** to perform expanding/contracting operations of the first and second trailing end regulating members **104** and **105**, which results in lowering usability.

Accordingly, the present invention provides an image forming apparatus that can improve usability.

SUMMARY OF THE INVENTION

The present invention provides an image forming apparatus. The image forming apparatus includes a sheet feeding apparatus that feeds a sheet stored in a sheet cassette and an image forming portion that forms an image on the sheet transmitted by the sheet feeding apparatus. The sheet cassette includes a cassette body that stores the sheet, a first regulating member that is provided in the cassette body to be slid in a forward-to-backward direction and regulates a trailing end of the sheet stored in the cassette body, a second regulating member that is provided in the first regulating member to be slid in a forward-to-backward direction and regulates the trailing end of the sheet stored in the cassette body, a first holding portion that holds the first regulating member in the cassette body, a second holding portion that holds the second regulating member in the first regulating member, and a common releasing portion that is operated when the first regulating member and the second regulating member are moved to trailing end regulation positions according to a size of the stored sheet and releases holding of the first regulating member by the first holding portion and holding of the second regulating member by the second holding portion. The common releasing portion has an operation portion that releases holding of the first holding portion and the second holding portion by a pressing operation in a direction that slidably moves the first regulating member and the second regulating member.

According to an embodiment of the present invention, the common releasing unit is operated, and the first and second regulating members can be moved by releasing holding of the first regulating member by a first holding mechanism and holding of the second regulating member by a second holding mechanism. Therefore, it is possible to improve usability.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating the schematic configuration of a laser beam printer that is an example of an image forming apparatus including a sheet feeding apparatus according to a first embodiment of the present invention.

FIG. **2** is a perspective view illustrating the configuration of a sheet cassette that is provided in the sheet feeding apparatus.

FIG. **3** is an exploded perspective view illustrating a trailing end regulating plate, a first trailing end regulating member, and a second trailing end regulating member that are provided in the sheet cassette.

FIG. **4** is a diagram illustrating a trailing end regulation position of the second trailing end regulating member, when a sheet having a size smaller than a length of a middle plate in a sheet feeding direction is stored in the sheet cassette.

FIG. **5** is a diagram illustrating the configuration of a first fixing mechanism for fixing the first trailing end regulating member.

FIG. **6** is a diagram illustrating the configuration of a second fixing mechanism for fixing the second trailing end regulating member.

FIG. **7** is a first diagram illustrating the configurations of the first fixing mechanism and the second fixing mechanism.

FIG. **8** is a second diagram illustrating the configurations of the first fixing mechanism and the second fixing mechanism.

FIG. **9**A is a third diagram illustrating the configuration of the second fixing mechanism.

FIG. **9**B is a third diagram illustrating the configuration of the first fixing mechanism.

FIG. **10** is a fourth diagram illustrating the configurations of the first fixing mechanism and the second fixing mechanism.

FIG. **11** is a diagram illustrating a state of when an operation portion of a trailing end regulating lever, which is provided in the second trailing end regulating member of the sheet cassette, is thrown in a direction illustrated by an arrow c.

FIG. **12** is a diagram illustrating a state of when an operation portion of a trailing end regulating lever, which is provided in the second trailing end regulating member of the sheet cassette, is thrown in a direction illustrated by an arrow d.

FIG. **13**A is a diagram illustrating a third locking member that is provided in the second trailing end regulating member.

FIG. **13**B is a partial enlarged view of FIG. **13**A.

FIG. **14**A is a diagram illustrating the operation of the third locking member.

FIG. **14**B is a partial enlarged view of FIG. **14**A.

FIG. **15** is a diagram illustrating a state of the second trailing end regulating member immediately before reaching from a small size storage position to an A5 storage position.

FIG. **16**A is a diagram illustrating a state where the third locking member is fixed.

FIG. **16**B is a partial enlarged view of FIG. **16**A.

FIG. **17** is a diagram illustrating the configurations of first and second cams provided in the trailing end regulating lever and first and second locking cams provided in the first fixing mechanism.

FIG. **18** is a diagram illustrating the configuration of a sheet cassette that is provided in an image forming apparatus including a sheet feeding apparatus according to a second embodiment of the present invention.

FIG. **19** is an enlarged view of a main portion of the sheet cassette.

FIG. **20** is a diagram illustrating a state of when an operation portion of a trailing end regulating lever, which is provided in a second trailing end regulating member of the sheet cassette, is thrown in a direction illustrated by an arrow c.

FIG. **21** is a diagram illustrating a state of when an operation portion of a trailing end regulating lever, which is provided in the second trailing end regulating member, is thrown in a direction illustrated by an arrow d.

FIG. **22** is a perspective view illustrating an expanding/contracting sheet cassette according to the related art.

FIG. **23**A is a diagram illustrating a position of a second trailing end regulating member when a sheet is stored in the sheet cassette according to the related art.

FIG. **23**B is a diagram illustrating a position of a second trailing end regulating member when a sheet is stored in the sheet cassette according to the related art.

DESCRIPTION OF THE EMBODIMENTS

Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.

FIG. **1** is a diagram illustrating the schematic configuration of a laser beam printer that is an example of an image forming apparatus including a sheet feeding apparatus according to a first embodiment of the present invention.

In FIG. **1**, a laser beam printer **1** has a laser beam printer body **1**A (hereinafter, referred to as printer body). Further, the laser beam printer **1** has a photosensitive drum **6** where a latent image is formed by a scanner unit **7**, a development device (not illustrated) that develops the latent image using a toner to form a toner image in the photosensitive drum **6**, and a process cartridge **112** that integrally includes a cleaner. In addition, an image forming portion **300** is formed using the photosensitive drum **6** and the development device (not illustrated).

Further, the laser beam printer **1** includes a sheet cassette **2** that is mounted to be detachably attached from the printer body **1**A, a sheet feeding roller **9** that feeds a sheet S stored in the sheet cassette **2**, and a sheet feeding apparatus **1**B that feeds the sheet S to the image forming portion **300**.

In addition, when an image is formed on the sheet S, the sheet S is transmitted to the image forming portion **300** by the sheet feeding roller **9** that serves as a sheet feeding member. First, the sheet S that is transmitted by the sheet feeding roller **9** is separated and fed one by one by a separation portion including the sheet feeding roller **9** and a friction plate **17**, and is then conveyed to a pair of conveying rollers **8**.

Next, the sheet S is conveyed from the pair of conveying rollers **8** to a pair of registration rollers **19**, subjected to skew feeding correction by the pair of registration rollers **19**, and conveyed to a transfer portion **15** formed by a transfer roller **10** and the photosensitive drum **6** at predetermined timing. In addition, in the transfer portion **15**, the toner image that has been formed on the photosensitive drum **6** is transferred by the transfer roller **10**.

Next, the sheet S where the toner image is transferred is conveyed to a fixer **11** and heated and pressurized by the fixer **11**. As a result, the toner image is fixed. Subsequently, the sheet S is discharged to a sheet discharge tray **14** by a lower sheet discharge roller **12** and an upper sheet discharge roller **13**.

Meanwhile, as illustrated in FIG. **2**, the sheet cassette **2** includes a cassette case **3** that constitutes the cassette body where the sheets are stored, a middle plate **31** that is rotatably provided in the cassette case **3** in an upward-to-downward direction, a width regulating plate **32**, and a trailing end regulating plate **33**. The middle plate **31** stacks the sheet, rotates in an upward-to-downward direction at the time of feeding the sheet, presses the sheet S by the sheet feeding roller **9**, and supports a sheet feeding operation. The middle plate **31** is provided with a slit **31***a* that a second trailing end regulating member (a second regulating member) **5** (which will be described in detail below) enters.

The width regulating plate **32** regulates a position of an end of the sheet in a width-wise direction, when the sheet is stored. Further, the trailing end regulating plate **33** regulates a position of a trailing end of the sheet, and includes a first trailing end regulating member (a first regulating member) **4** and a second trailing end regulating member **5**.

As illustrated in FIG. **3**, the first trailing end regulating member **4** includes a body **4**A that abuts the trailing end of the sheet and a supporting surface **4**B that supports a portion of the trailing end of the sheet. In addition, the first trailing end regulating member **4** is mounted in the cassette case **3** to be slid in a forward-to-backward direction. Further, the second trailing end regulating member **5** is provided at a center portion of the first trailing end regulating member **4** in a width-wise direction to be slid in a forward-to-backward direction with respect to the first trailing end regulating member **4**.

In addition, when the sheet is stored in the sheet cassette **2**, the width regulating plate **32** and the trailing end regulating plate **33** are moved to positions according to the size of the sheet, and an end of the sheet is regulated by the width regulating plate **32**. Meanwhile, the trailing end of the sheet is regulated by the first and second trailing end regulating members **4** and **5**. As a result, it is possible to stably feed an arbitrary sheet without depending on the size of the sheet.

FIG. **2** illustrates positions of the first and second trailing end regulating members **4** and **5** when a trailing end of a sheet having a large size is regulated. FIG. **4** illustrates a position of the second trailing end regulating member **5**, when a trailing end of a sheet, which has a size smaller than a predetermined size shorter than a length of the middle plate **31** in a sheet feeding direction, for example, an A5 size, is regulated. In this case, the trailing end of the sheet is regulated by inserting the second trailing end regulating member **5** into the slit **31***a* that is formed in the middle plate **31**.

Meanwhile, as described above, the first trailing end regulating member **4** can be slid with respect to the cassette case **3**. In addition, when the trailing end of the sheet is regulated, after moving the second trailing end regulating member **5** and the first trailing end regulating member **4** to the trailing end regulation positions, it is needed to fix (hold) the first and second trailing end regulating members **4** and **5** to the trailing end regulation positions. As such, in order to fix (hold) the first and second trailing end regulating members **4** and **5** to the trailing end regulation positions, a first fixing mechanism **2**A and a second fixing mechanism **2**B are provided in this embodiment.

Next, the configurations of the first and second fixing mechanisms **2**A and **2**B that fix the first and second trailing end regulating members **4** and **5** will be described. First, the configuration of the first fixing mechanism **2**A that fixes the first trailing end regulating member **4** will be described.

As illustrated in FIG. **5**, the first fixing mechanism **2**A is provided on a bottom surface **3***a* of the cassette case **3**, and is formed using a plurality of triangle teeth. The first fixing mechanism **2**A includes a first rack tooth row **34** and a second rack tooth row **35** that extend in parallel along a sheet feeding direction and serve as a first engagement unit. Further, the first fixing mechanism **2**A includes a first locking member **42** serving as a first holding portion that is held in the first trailing end regulating member **4** to rotate. In this case, a bottom surface of the first locking member **42** is provided with a first tooth row **48** and a second tooth row **49**. The first tooth row **48** and the second tooth row **49** are formed of triangle teeth to correspond to the first rack tooth row **34** and the second rack tooth row **35**.

As in this embodiment, if each of the first and second tooth rows **48** and **49** and the first and second rack tooth rows **34** and **35** is formed of the triangle teeth, it is possible to secure mechanically high holding strength. As a result, pitches of the first and second tooth rows **48** and **49** and the first and second rack tooth rows **34** and **35** can be decreased, which results in minutely adjusting a setting position of the first trailing end regulating member **4** to an arbitrary position.

Further, in this embodiment, the tooth of each of the first tooth row **48** and the first rack tooth row **34** has a surface approximately vertical to a large size regulation direction,

such that a strong resisting force is generated at the time of moving the first trailing end regulating member **4** in the large size regulation direction. In addition, when a force is applied to the first trailing end regulating member **4** in the large size regulation direction, an approximately vertical surface of each of the first tooth row **48** and the first rack tooth row **34** is welded with pressure.

As such, when a force is applied to the first trailing end regulating member **4** in the large size regulation direction, since the approximately vertical surface of each of the first tooth row **48** and the first rack tooth row **34** is welded with pressure, the first trailing end regulating member **4** can receive the force. As a result, it is possible to secure the high holding force of the first trailing end regulating member **4**.

Further, the tooth of each of the second tooth row **49** and the second rack tooth row **35** has a shape that is opposite to the shape of each of the first tooth row **48** and the first rack tooth row **34**. Specifically, the tooth of each of the second tooth row **49** and the second rack tooth row **35** has a surface approximately vertical to a small size regulation direction, such that a strong resisting force is generated at the time of moving the first trailing end regulating member **4** in the small size regulation direction. In addition, when a force is applied to the first trailing end regulating member **4** in the small size regulation direction, an approximately vertical surface of each of the second tooth row **49** and the second rack tooth row **35** is abutted. Therefore, the first trailing end regulating member **4** can receive the force. As a result, it is possible to secure the high holding force of the first trailing end regulating member **4**.

Next, the configuration of the second fixing mechanism **2**B that fixes the second trailing end regulating member **5** will be described.

As illustrated in FIG. **6**, the second fixing mechanism **2**B is provided on a supporting surface **4**B of the first trailing end regulating member **4**, and is formed using a plurality of triangle teeth. The second fixing mechanism **2**B includes a third rack tooth row **36** and a fourth rack tooth row **37** that extend in parallel along a sheet feeding direction and serve as a second engagement unit. Further, the second fixing mechanism **2**B includes a second locking member **52** serving as a second holding portion that is held in a body **51** of the second trailing end regulating member **5** to move in an upward-to-downward direction. In this case, a bottom surface of the second locking member **52** is provided with the third tooth row **58** and the fourth tooth row **59** to correspond to the third rack tooth row **36** and the fourth rack tooth row **37**.

As in this embodiment, if each of the third and fourth tooth rows **58** and **59** and the third and fourth rack tooth rows **36** and **37** is formed of the triangle teeth, it is possible to secure mechanically high holding strength. As a result, pitches of the third and fourth tooth rows **58** and **59** and the third and fourth rack tooth rows **36** and **37** can be decreased, which results in minutely adjusting a setting position of the second trailing end regulating member **5** to an arbitrary position.

Further, in this embodiment, the tooth of each of the third tooth row **58** and the third rack tooth row **36** has a surface approximately vertical to a large size regulation direction, such that a strong resisting force is generated at the time of moving the second trailing end regulating member **5** in the large size regulation direction. In addition, when a force is applied to the second trailing end regulating member **5** in the large size regulation direction, an approximately vertical surface of each of the third tooth row **58** and the third rack tooth row **36** is welded with pressure.

As such, when a force is applied to the second trailing end regulating member **5** in the large size regulation direction, since the approximately vertical surface of each of the third tooth row **58** and the third rack tooth row **36** is welded with pressure, the second trailing end regulating member **5** can receive the force. As a result, it is possible to secure the high holding force of the second trailing end regulating member **5**.

Further, the tooth of each of the fourth tooth row **59** and the fourth rack tooth row **37** has a shape that is opposite to the shape of the third tooth row **58** and the third rack tooth row **36**. Specifically, the tooth of each of the fourth tooth row **59** and the fourth rack tooth row **37** has a surface approximately vertical to a small size regulation direction, such that a strong resisting force is generated at the time of moving the second trailing end regulating member **5** in the small size regulation direction. In addition, when a force is applied to the second trailing end regulating member **5** in the small size regulation direction, an approximately vertical surface of each of the fourth tooth row **59** and the fourth rack tooth row **37** is abutted. Therefore, the second trailing end regulating member **5** can receive the force. As a result, it is possible to secure the high holding force of the second trailing end regulating member **5**.

Further, in this embodiment, the trailing end regulating direction of the first and second trailing end regulating members **4** and **5** is the same as a direction where the sheet cassette **2** is inserted into the printer body **1**. For this reason, if the sheet cassette **2** is powerfully inserted into the printer body in a state where the sheet is stored, a shock according to a capacity of the sheet is applied to the first and second trailing end regulating members **4** and **5**.

At this time, if a load (shock) is differently applied to the left and right sides, the first trailing end regulating member **4** may be slightly inclined. In this case, if the first trailing end regulating member **4** is inclined, a posture of the sheets stored in the sheet cassette whose trailing end is regulated and supported by the first trailing end regulating member **4** varies. As a result, when the sheet is fed, a disadvantage, such as skew feeding and jamming, may occur. For this reason, in this embodiment where the load is made to be equally applied to the first and second trailing end regulating members **4** and **5**, the first to fourth rack tooth rows **34** to **37** are disposed toward the center of a width-wise direction, as illustrated in FIGS. **7** and **8**.

Further, since the sheet cassette **2** is powerfully inserted into the printer body in a state where the sheet is stored, the first and fourth rack tooth rows **34** and **37** where the shock according to the storage amount of the sheet is directly applied need to have strengths stronger than those of the second and third rack tooth rows **35** and **36**. Accordingly, in this embodiment, the first and fourth rack tooth rows **34** and **37** have tooth widths that are larger than those of the third and fourth rack tooth rows **35** and **36**. In this case, the first tooth row **48** of the first locking member **42** and the third tooth row **58** of the second locking member **52** that are engaged with the first and fourth rack tooth rows **34** and **37** also have tooth widths that are larger than those of the second tooth row **49** and the fourth tooth row **59**, as illustrated in FIG. **9**.

Meanwhile, when the first and second trailing end regulating members **4** and **5** are moved, it is needed to release the fixations by the first and second fixing mechanisms **2**A and **2**B that have the above-described configuration. Next, the configuration for releasing the fixations of the first and second fixing mechanisms **2**A and **2**B will be described.

As illustrated in FIGS. **6** and **10**, a trailing end regulating lever **61** is provided in the second trailing end regulating member **5** to rotate. In this case, an operation portion **62** that a user contacts is provided on the trailing end regulating lever **61**. A first cam **63** and a second cam **64** that abut the first

locking member **42** and a third cam **65** and a fourth cam **66** that abut the second locking member **52** are provided below the trailing end regulating lever **61**.

In FIG. **10**, a first locking spring **43** is provided at a position that corresponds to the first and second tooth rows **48** and **49** of the first locking member **42**. In addition, since the first locking member **42** is pushed by the first locking spring **43**, the first trailing end regulating member **4** is held with respect to the cassette case **3**.

Further, the first locking member **42** is disposed in the first trailing end regulating member **4** to rock around a rocking shaft **42***a* as a fulcrum. One rocking end is provided with the first and second tooth rows **48** and **49** and the other rocking end is provided with the first and second locking cams **46** and **47**.

Meanwhile, below the rotation center of the trailing end regulating lever **61**, a first cam **63** and a second cam **64** that have a cam shape are provided. The first cam **63** and the second cam **64** constitute a first holding releasing portion that rotates the first locking member **42** and releases locking of the first trailing end regulating member **4** by the first locking member **42**.

Further, at the side of the first locking member below the trailing end regulating lever **61**, the first cam **63** and the second cam **64** are provided to correspond to the first and second locking cams **46** and **47** of the first locking member **42**. Further, the first locking cam **46** and the second locking cam **47** of the first locking member **42** protrude more upward than the supporting surface **4**B of the first trailing end regulating member **4**, such that the second trailing end regulating member **5** can be attached to or detached from the first trailing end regulating member **4**, which will be described in detail below.

In FIG. **10**, a second locking spring **53** biases the second locking member **52**. If the force is applied to the second locking member **52** by the second locking spring **53**, the second trailing end regulating member **5** is held in the first trailing end regulating member **4**.

In this case, the second locking member **52** is disposed to move upward and downward with respect to the second trailing end regulating member **5**. A third locking cam **56** and a fourth locking cam **57** are provided between the second locking spring **53** and the third and fourth tooth rows **58** and **59** provided at the lower end, as illustrated in FIG. **6**.

Meanwhile, slightly above the rotation center of the trailing end regulating lever **61**, a third cam **65** and a fourth cam **66** that have a cam shape are provided. The third cam **65** and the fourth cam **66** constitute a second holding releasing portion that descends the second locking member **52** and releases locking of the second trailing end regulating member **5** by the second locking member **52**. Further, the third cam **65** and the fourth cam **66** are provided to correspond to the third locking cam **56** and the fourth locking cam **57** of the second locking member **52**. At this time, the third cam **65** and the fourth cam **66** are provided such that positions (heights) of action points thereof are approximately the same.

Next, the operation of changing a state of the first trailing end regulating member **4** from a holding state to a releasing state when the first trailing end regulating member **4** moves to a position according to the size of the sheet will be described.

In this case, the operation portion **62** of the trailing end regulating lever **61** is thrown in a direction illustrated by an arrow c or d in FIG. **10**. As a result, each of the cams **63** to **66** of the trailing end regulating lever **61** rotates and acts on each of the locking cams **46**, **47**, **56**, and **57** of the corresponding first and second locking members **42** and **52**. Therefore, the first and second locking members **42** and **52** move in a releasing direction from the holding positions.

For example, as illustrated in FIG. **11**, when the operation portion **62** of the trailing end regulating lever **61** is thrown in a direction illustrated by the arrow c, the trailing end regulating lever **61** rotates around a rotation shaft, and the first cam **63** of the trailing end regulating lever **61** pushes down the first locking cam **46** of the first locking member **42**.

Thereby, the first locking member **42** rocks around a rocking shaft **42***a* in a holding releasing direction while being against a pressing force of the first locking spring **43**, and the first and second tooth rows **48** and **49** that are provided opposite to the first locking member **42** with the rocking shaft **42***a* therebetween are pushed up. As a result, engagement of the first and second tooth rows **48** and **49** of the first locking member **42** and the first and second rack tooth rows **34** and **35** of the cassette case **3** is released, and the state of the first trailing end regulating member **4** is changed from the holding state to the releasing state, with respect to the cassette case **3**.

At the same time, in regards to the second trailing end regulating member **5**, since the third cam **65** of the trailing end regulating lever **61** pushes up the third locking cam **56** of the second locking member **52**, the second locking member **52** is pushed up in an upward direction as a holding releasing direction while being against the pressing force of the second locking spring **53**. As a result, engagement of the third and fourth tooth rows **58** and **59** of the second locking member **52** and the third and fourth rack tooth rows **36** and **37** of the first trailing end regulating member **4** is released, and the state of the second trailing end regulating member **5** is changed from the holding state to the releasing state, with respect to the first trailing end regulating member **4**.

Meanwhile, as illustrated in FIG. **12**, when the operation portion **62** of the trailing end regulating member **61** is thrown in a direction illustrated by the arrow d, the trailing end regulating lever **61** rotates around a rotation shaft, and the second cam **64** of the trailing end regulating lever **61** pushes down the second locking cam **47** of the first locking member **42**.

Thereby, the first locking member **42** rocks around a rocking shaft **42***a* while being against the pressing force of the first locking spring **43**, and the first and second tooth rows **48** and **49** are pushed up. As a result, engagement of the first and second tooth rows **48** and **49** of the first locking member **42** and the first and second rack tooth rows **34** and **35** of the cassette case **3** is released, and the state of the first trailing end regulating member **4** is changed from the holding state to the releasing state, with respect to the cassette case **3**.

At the same time, in regards to the second trailing end regulating member **5**, since the fourth cam **66** of the trailing end regulating lever **61** pushes up the fourth locking cam **57** of the second locking member **52**, the second locking member **52** is pushed up while being against the pressing force of the second locking spring **53**. As a result, engagement of the third and fourth tooth rows **58** and **59** of the second locking member **52** and the third and fourth rack tooth rows **36** and **37** of the first trailing end regulating member **4** is released, and the state of the second trailing end regulating member **5** is changed from the holding state to the releasing state, with respect to the first trailing end regulating member **4**.

Further, if the trailing end regulating lever **61** is excessively thrown, there occur problems in the contact and separation operations of all the engaging portions and the motions of all the corresponding cam portions. Accordingly, the amount that a user throws the trailing end regulating lever **61** is set to the proper thrown amount by means of a stopper (not illustrated) that enables the trailing end regulating lever to be

properly thrown. Further, in the case where the trailing end regulating lever **61** is thrown, that is, the first and second trailing end regulating members **4** and **5** become a releasing state, if the user lets the trailing end regulating lever **61** go, due to the pressing forces of the first and second locking springs **43** and **53**, the trailing end regulating lever **61** is automatically returned to the original position. As a result, the first and second trailing end regulating members **4** and **5** are returned to the holding state at the moved positions.

As described above, in this embodiment, regardless of the direction where the operation portion **62** of the trailing end regulating lever **61** serving as the common releasing portion that is a unique user operation portion is thrown, both the first trailing end regulating member **4** and the second trailing end regulating member **5** can enter into a releasing state. That is, according to this embodiment, the user operates one trailing end regulating lever **61** to make the first and second trailing end regulating members **4** and **5** enter in a locking holding state or a locking releasing state. Further, the user operates one trailing end regulating lever **61** to move the first and second trailing end regulating members **4** and **5** in the same direction as the operation direction of the trailing end regulating lever **61**, thereby moving the first and second trailing end regulating members **4** and **5** to the trailing end regulation positions according to the size of the sheet. Further, the user operates one trailing end regulating lever **61** to move the first and second trailing end regulating members **4** and **5** in a direction opposite to the operation direction of the trailing end regulating lever **61**.

Meanwhile, as described above, in this embodiment, when the sheet is stored, it is possible to slidably move the first and second trailing end regulating members **4** and **5** to the positions according to the size of the sheet, that is, the length of the sheet in the sheet feeding direction.

In this case, when the first and second trailing end regulating members **4** and **5** are slid and the sheet has the predetermined length in the sheet feeding direction or more, the first and second trailing end regulating members **4** and **5** can be integrally slid, such that the position of the trailing end of the sheet is regulated by the first and second trailing end regulating members **4** and **5**. Further, when the sheet does not have the predetermined length in the sheet feeding direction or more, that is, the sheet has the small size of the predetermined size or less, only the second trailing end regulating member **5** is slid.

In this embodiment, the sheet having the minimum size in a range where the first and second trailing end regulating members **4** and **5** can be integrally slid is used as a sheet having an A5 size, and in the case of the sheet that has the size smaller than the size of the sheet having the A5 size, only the second trailing end regulating member **5** is slid.

In this case, in the case of storing the sheet that has the size larger than the size of the sheet having the A5 size, a third locking member **54** is provided to integrate the second trailing end regulating member **5** with the first trailing end regulating member **4**, such that the first and second trailing end regulating members **4** and **5** are integrally slid.

Further, the third locking member **54** serving as a connecting portion that connect the first and second trailing end regulating members **4** and **5** is provided to move in a direction vertical to the second trailing end regulating member **5**, as illustrated in FIG. **13**. In addition, the third locking member **54** has an inserting portion **79** having a protrusion shape formed at a lower end, and the inserting portion **79** is inserted into a slit portion **67** that is formed in the first trailing end regulating member **4**, by means of a pressing force by the third locking spring **55** that biases to an upper end.

As a result, the second trailing end regulating member **5** is configured such that it is not deviated in a forward-to-backward direction, with respect to the first trailing end regulating member **4**. Further, since the third locking member **54** is restricted in a forward-to-backward direction with respect to the second trailing end regulating member **5**, the first trailing end regulating member **4** and the second trailing end regulating member **5** are integrated with each other.

Further, when the first trailing end regulating member **4** moves to the cassette case **3** in a state where the first and second trailing end regulating members **4** and **5** are integrated with each other, the user throws, in a movement direction, the operation portion **62** of the trailing end regulating lever **61** that is provided in the second trailing end regulating member **5** to rotate, as described above. Thereby, locking of the second trailing end regulating member **5** with respect to the first trailing end regulating member **4** is released at the same time as when locking of the first trailing end regulating member **4** with respect to the cassette case **3** is released.

However, even when locking of the second trailing end regulating member **5** with respect to the first trailing end regulating member **4** is released, the inserting portion **79** of the third locking member **54** is engaged with the slit portion **67** of the first trailing end regulating member **4**. Therefore, the first and second trailing end regulating members **4** and **5** are integrated with each other.

For this reason, if the user pushes the trailing end regulating lever **61**, the third locking member **54** is engaged with the slit portion **67** of the first trailing end regulating member **4**. Therefore, the second trailing end regulating member **5** moves in a state where the second trailing end regulating member **5** is integrated with the first trailing end regulating member **4**. In this case, the second trailing end regulating member **5** moves to the cassette case **3** in a state where the first and second trailing end regulating members **4** and **5** are integrated with each other, without depending on whether the movement direction of the first trailing end regulating member **4** is approximately equal to or opposite to the direction where the operation portion **62** of the trailing end regulating lever **61** is thrown.

In this embodiment, as described above, the inserting portion **79** of the third locking member **54** is inserted into the slit portion **67** of the first trailing end regulating member **4** without a deviation in a forward-to-backward direction. However, the inserting portion **79** of the third locking member **54** may be inserted into the slit portion **67** so as not to deviate in only a forward direction (sheet feeding direction), and the second trailing end regulating portion **5** may directly bump the first trailing end regulating member **4** in a backward direction. In this way, the first trailing end regulating member **4** and the second trailing end regulating member **5** may be restricted in a forward-to-backward direction and may be integrated with each other.

Meanwhile, when the sheet that has the size smaller than the size of the sheet having the A5 size is stored in the sheet cassette **2**, the second trailing end regulating member **5** is separated from the first trailing end regulating member **4**, such that the only the second trailing end regulating member **5** is slid on the first trailing end regulating member.

Next, the configuration where only the second trailing end regulating member **5** is slid will be described. In this embodiment, when the first trailing end regulating member **4** is slid, if the first and second trailing end regulating members **4** and **5** are integrally moved to the storage position of the sheet having the A5 size, a tip of the first trailing end regulating member **4** at the front side bumps a bump portion (not illustrated) of the cassette case **3**. As a result, the first trailing end

regulating member **4** cannot move to the downstream side of the sheet feeding direction, that is, the middle plate side. Hereinafter, a storage position of a sheet that has the A5 size is called an A5 storage position, a storage position of a sheet that has a size smaller than the A5 size is called a small size storage position, and a storage position of a sheet that has a size larger than the A5 size is called a large size storage position.

In this case, in order to separate the second trailing end regulating member **5** from the first trailing end regulating member **4** and enable only the second trailing end regulating member **5** to be slid, it is needed to release engagement of the third locking member **54** and the slit portion **67** of the first trailing end regulating member **4**.

For this reason, in this embodiment, as illustrated in FIG. **13**, the cassette case **3** is provided with a third locking releasing rib **38** serving as a connection releasing member that includes an inclined portion **77** to release locking by the third locking member **54**. In addition, if the first trailing end regulating member **4** that exists at a position corresponding to the sheet having a size larger than the A5 size is slid in a trailing end regulation direction up to a position that corresponds to a sheet having a small size, the inserting portion **79** of the third locking member **54** abuts the inclined portion **77** of the third locking releasing rib **38**.

In this case, if the first trailing end regulating member **4** is further moved after the inserting portion **79** abuts the inclined portion **77**, the third locking member **54** is pushed by the inclined portion **77** of the third locking releasing rib **38** while being against the third locking spring **55**. As illustrated in FIG. **14**, the third locking member **54** moves upward in the second trailing end regulating member. As a result, the inserting portion **79** of the third locking member **54** gets out of the slit portion **67** of the first trailing end regulating member **4**, and the second trailing end regulating member **5** is separated from the first trailing end regulating member **4**.

In this embodiment, when the third locking member **54** is engaged with the slit portion **67**, as illustrated in FIG. **13**, the height of an upper end surface of the third locking releasing rib **38** is set to be higher than the height of a lower end surface of the slit portion **67**, thereby overlapping the third locking member and the slit portion each other in an upward-to-downward direction. As a result, the inserting portion **79** of the lower end of the third locking member **54** may easily get out of the slit portion **67** of the first trailing end regulating member **4**.

Further, in order to make the inserting portion **79** of the third locking member **54** easily get out of the slit portion **67** of the first trailing end regulating member **4**, the tip of the inserting portion **79** is formed in an approximately V shape. Further, a taper portion **78** that is an inclined surface for C chamfering is provided on a side end of the slit portion **67** of the first trailing end regulating member **4** in a sheet feeding direction.

In this case, in order that the V shape of the inserting portion **79** of the third locking member **54** and the taper portion **78** of the slit portion **67** do not bump each other in a state where the third locking member **54** and the slit portion **67** are engaged with each other, vertical surfaces of the inserting portion **79** and the slit portion **67** bump each other. Further, when the first trailing end regulating member **4** is at the A5 size storage position, the inclined portion **77** of the third locking releasing rib **38** is provided at a position to guide the inserting portion **79**, such that the vertical surfaces of the inserting portion **79** of the third locking member **54** and the slit portion **67** do not bump each other.

The reason of such configuration is as follows. At the A5 storage position, if the vertical surfaces of the inserting portion **79** and the slit portion **67** bump each other, the inserting portion **79** cannot move upward along the inclined portion **77** of the third locking releasing rib **38**, when the first trailing end regulating member **4** is moved to the small size storage position. This is because the first trailing end regulating member **4** bumps the cassette case **3** and does not move, in the above state. In this case, the third locking member **54** cannot get out of the slit portion **67** and the second trailing end regulating member **5** cannot be separated from the first trailing end regulating member **4**.

Accordingly, in this embodiment, as described above, the V shape is provided in the inserting portion **79** of the third locking member **54**, the taper shape is provided in the slit portion **67**, and a guide portion that moves the inserting portion **79** upward is formed by the V shape and the taper shape.

In addition, when the guide portion is provided and the first trailing end regulating member **4** is moved from the large size storage position to the small size storage position, the third locking member **54** can be moved upward from the arbitrary position to the A5 storage position, by the inclined portion **77** of the third locking releasing rib **38**. Further, when the third locking member **54** is moved to the small size storage position, the inserting portion **79** of the third locking member **54** that moves in a forward direction together with the second trailing end regulating member **5** is moved upward by the guide portion. As a result, the third locking member **54** gets out of the slit portion **67** of the first trailing end regulating member **4** and the second trailing end regulating member **5** is separated from the first trailing end regulating member **4**.

Further, an angle (hereinafter, referred to as inclined angle α) of the inclined portion **77** of the third locking releasing rib **38** with respect to a sliding direction (approximately horizontal direction in this embodiment) of the first trailing end regulating member **4** is set to be smaller than a V shape angle γ of the inserting portion **79** of the third locking member **54**. Further, the inclined angle α of the inclined portion **77** of the third locking releasing rib **38** is set to be smaller than an angle (hereinafter, referred to as taper angle β) of the taper portion **78** of the slit portion **67** with respect to a sliding direction of the first trailing end regulating member **4**.

If the first trailing end regulating member **4** is moved from the large size storage position A5 to the A5 storage position, the vertical surfaces of the inserting portion **79** of the third locking member and the slit portion **67** of the first trailing end regulating member **4** contact with each other, until the position right before the A5 storage position. As a result, the first and second trailing end regulating members **4** and **5** integrally move. Then, due to the operation of the third locking releasing rib **38** of the cassette case **3** at the A5 storage position, the inserting portion **79** of the third locking member is moved more upward than the slit portion **67** of the first trailing end regulating member **4**, and engagement is released.

However, when the variation in the component precision or gutter is generated, the forward movement of the inserting portion **79** of the third locking member cannot be surely made. Further, when the variation in the component precision or gutter is generated, as described above, at the A5 storage position, the vertical surfaces of the inserting portion **79** of the third locking member **54** and the slit portion **67** of the first trailing end regulating member **4** may contact with each other.

For this reason, right before the first trailing end regulating member **4** is moved from the large size storage position to the A5 storage position, the inclined portion **77** of the third locking releasing rib **38** acts and pushes up the third locking member **54**. As a result, the vertical surfaces of the inserting

portion **79** of the third locking member **54** and the slit portion **67** do not abut and the inclined surfaces in any one or both of them contact with each other.

At this time, since the tip of the first trailing end regulating member **4** at the front side does not reach the bump portion of the cassette case **3**, the tip of the first trailing end regulating member **4** at the front side needs to surely bump the bump portion of the cassette case **3**. Accordingly, in order to make the tip of the first trailing end regulating member **4** at the front side surely bump the bump portion of the cassette case **3**, an angle of the inclined surfaces in any one or both of the inserting portion **79** of the third locking member **54** and the slit portion **67** of the first trailing end regulating member **4** is set to a large value.

As a result, since it is possible to make the forward movement of the third locking member **54** along the inclined portion **77** of the third locking releasing rib **38** against a pressing force of the third locking spring **55** difficult, the inserting portion **79** can push out the slit portion **67** forward, even though the vertical surfaces do not contact with each other. As a result, the first trailing end regulating member **4** can be surely moved to the bump portion of the cassette case **3**. In addition, the first and second trailing end regulating members **4** and **5** can be surely moved to the A5 size storage position, in a state where the first and second trailing end regulating members **4** and **5** are integrated with each other.

Further, if the angles of the inclined surfaces of the inserting portion **79** and the slit portion **67** are set to large values, when the first and second trailing end regulating members **4** and **5** are at the A5 size storage positions and the operation portion is pushed into the small size storage position, it is possible to make the upward movement of the third locking member **54** difficult. As a result, even though the vertical surfaces do not contact with each other, the inserting portion **79** of the third locking member **54** can push out the slit portion **67** of the first trailing end regulating member **4** in a forward direction.

Hereinafter, the inclination angle α of the third locking releasing rib **38** will be described in detail. In this embodiment, if the first trailing end regulating member **4** is moved from the large size storage position to the small size storage position, as described above, the inserting portion **79** of the third locking member **54** abuts the inclined portion **77** of the third locking releasing rib **38**. Then, if the first trailing end regulating member **4** is moved, the third locking member **54** is pushed by the inclined portion **77** of the third locking releasing rib **38** while being against the pressing force of the third locking spring **55**, and moves upward in the second trailing end regulating member **5**.

At this time, in order that the operation force, which is needed to move the first trailing end regulating member **4**, is not stronger than that before the inserting portion **79** of the third locking member **54** abuts the inclined portion **77** of the third locking releasing rib **38**, the inclination angle α of the third locking releasing rib **38** is set as small as possible.

However, when the first trailing end regulating member **4** is moved from the large size storage position to the peripheral portion of the A5 storage position, the vertical surfaces of the inserting portion **79** of the third locking member **54** and the slit portion **67** contact with each other and at least one of the inserting portion **79** and the slit portion **67** contacts at the inclined surface. As a result, the inserting portion **79** of the third locking member **54** easily gets out of the slit portion **67** of the first trailing end regulating member **4**.

For this reason, if the V shape angle γ of the inserting portion **79** of the third locking member **54** is set to be smaller than or approximately equal to the inclination angle α of the third locking releasing rib **38**, the second trailing end regulating member **5** may be separated from the first trailing end regulating member **4** before the first trailing end regulating member **4** bumps the bump portion. That is, the second trailing end regulating member **5** may be separated from the first trailing end regulating member **4** before the first trailing end regulating member **4** moves to the A5 storage position.

Further, if the taper angle β of the slit portion **67** is set to be smaller than or approximately equal to the inclination angle α of the third locking releasing rib **38**, the second trailing end regulating member **5** may be separated from the first trailing end regulating member **4** before the first trailing end regulating member **4** bumps the bump portion of the cassette case **3**.

Meanwhile, as described above, the second trailing end regulating member **5** needs to be separated from the first trailing end regulating member **4** after the tip of the first trailing end regulating member **4** at the front side surely bumps the bump portion of the cassette case **3**. Accordingly, as described above, the V shape angle γ of the inserting portion **79** of the third locking member **54** or the taper angle β of the slit portion **67** of the first trailing end regulating member **4** is set to be larger than the inclination angle α of the third locking releasing rib **38**.

By this configuration, the operation force that is needed in a state where the inserting portion **79** abuts the inclined portion **77** and moves in an upward direction can be made to be stronger than the operation force that moves the first trailing end regulating member **4** in a forward direction, even though the inserting portion **79** abuts the slit portion **67**. As a result, it is possible to move the first trailing end regulating member **4** until the tip of the first trailing end regulating member **4** at the front side surely bumps the bump portion of the cassette case **3**. Further, it is possible to integrally move the first trailing end regulating member **4** and the second trailing end regulating member **5** to the A5 storage position.

Further, when the first trailing end regulating member **4** is further moved to the small size storage position from the A5 storage position, for example, the first and second cams **63** and **64** of the trailing end regulating lever **61** illustrated in FIG. **10** and the first and second locking cams **46** and **47** of the first locking member **42** need to be separated from each other. That is, when the second trailing end regulating member **5** is separated from the first trailing end regulating member **4**, the first and second cams **63** and **64** of the trailing end regulating lever **61** need to be separated from the first and second locking cams **46** and **47** of the first locking member **42**.

Accordingly, in this embodiment, as illustrated in FIGS. **10** to **12**, the position of the action point of the second cam **64** that is located at the upstream side of the trailing end regulating lever **61** in the sheet feeding direction is set to be higher than the position of the action point of the first cam **63** that is located at the downstream side of the trailing end regulating lever **61** in the sheet feeding direction. Further, in the same way, the position of the second locking cam **47** of the first locking member **42** is also set to be higher than the position of the first locking cam **46**.

As a result, even though the first trailing end regulating member **4** is moved in a state where the user throws the operation portion **62** of the trailing end regulating lever **61** in either a c direction or a d direction, with respect to a progress direction when the second trailing end regulating member **5** is separated from the first trailing end regulating member **4**, engagement due to a reverse step is decreased. As a result, when the first trailing end regulating member **4** is further moved to the small size storage position from the A5 storage position, the first and second trailing end regulating members **4** and **5** may be easily separated from each other.

By this configuration, while the first trailing end regulating member **4** is moved from the large size storage position to the small size storage position by operating the operation portion **62** of the trailing end regulating lever **61** that is mounted in the second trailing end regulating member **5**, the first trailing end regulating member **4** and the second trailing end regulating member **5** can be separated from each other.

Meanwhile, when the first trailing end regulating member **4** is moved from the large size storage position to the A5 storage position, the first and second tooth rows **48** and **49** of the first locking member **42** and the first and second rack tooth rows **34** and **35** of the cassette case **3** are separated from each other.

Further, when the first trailing end regulating member **4** is moved from the A5 storage position to the small size storage position, the first and second trailing end regulating members **4** and **5** are separated from each other. For this reason, the first and second cams **63** and **64** of the trailing end regulating lever **61** are separated from the first and second locking cams **46** and **47** of the first locking member **42**, which are opposite to the first and second cams **63** and **64**. At this time, since the first and second tooth rows **48** and **49** of the first locking member **42** and the first and second rack tooth rows **34** and **35** of the cassette case **3** are engaged with each other, the first trailing end regulating member **4** is held in the cassette case **3** at the A5 storage position.

Further, if the operation portion **62** of the trailing end regulating lever **61** is operated, only the second trailing end regulating member **5** moves forward on the first trailing end regulating member **4** that is held in the cassette case **3**. Then, the tip of the second trailing end regulating member **5** at the front side bumps a bump portion different from the first trailing end regulating member **4** that is provided in the cassette case **3** and is stopped. This state becomes a storage state of the sheet that has a minimum size in this embodiment.

Further, if the user holds the operation portion **62** of the trailing end regulating lever **61** and then lets it go, that is, the operation force that is applied to the operation portion **62** is released, the pushing up of the third and fourth locking cams **56** and **57** of the second locking member **52** by the third and fourth cams **65** and **66** of the trailing end regulating lever **61** is released. As a result, the second locking member **52** descends due to the pressing force applied to the lower side of the second locking spring **53**.

As a result, the third and fourth tooth rows **58** and **59** provided at the lower end of the second locking member **52** are engaged with the third and fourth rack tooth rows **36** and **37** provided in the first trailing end regulating member **4** that is engaged with the cassette case **3**, and the second trailing end regulating member **5** is held with respect to the first trailing end regulating member **4**.

As such, even in the storage state of the sheet that has the minimum size, that is, a state where the first trailing end regulating member **4** and the second trailing end regulating member **5** are separated from each other, the first and second trailing end regulating members **4** and **5** can be held with respect to the cassette case **3**.

Next, the operation of changing the state of the sheet cassette **2** from the storage state of the sheet having the minimum size to the storage state of the sheet having the A5 size and the storage state of the sheet having the maximum size, and extending the sheet cassette in a direction that increases the length of the sheet feeding direction will be described.

When the setting of the sheet cassette **2** is changed from the state where the minimum size specification is set to the storage state of the sheet having the A5 size, first, the operation portion **62** of the trailing end regulating lever **61** is thrown in either a forward direction or a backward direction. As a result, as described above, the second cam **65** of the trailing end regulating lever **61** lifts the second locking member **52**, and locking of the second trailing end regulating member **5** with respect to the first trailing end regulating member **4** is released.

At this time, since the first trailing end regulating member **4** is locked to the cassette case **3**, if the operation portion **62** of the trailing end regulating lever **61** is further moved in a backward direction, the second trailing end regulating member **5** is slid on the trailing end regulating plate and moved to the A5 storage position.

As such, if the second trailing end regulating member **5** moves to the A5 storage position, the third locking member **54** that has been moved integrally with the second trailing end regulating member **5** along the third locking releasing rib **38** is separated from the third locking releasing rib **38**. Thereby, the third locking member **54** is engaged with the slit portion **67** by means of a downward pressing force of the third locking spring **55**, and the first trailing end regulating member **4** and the second trailing end regulating member **5** are integrated with each other.

Meanwhile, immediately before reaching the A5 storage position, as illustrated in FIG. **15**, the first and second cams **63** and **64** of the trailing end regulating lever **61** approach the first and second locking cams **46** and **47** of the first locking member **42** such that they abut the first and second locking cams **46** and **47** from the separation state. At this time, the first and second cams **63** and **64** and the first and second locking cams **46** and **47** may bump each other.

That is, before the second trailing end regulating member **5** reaches the A5 storage position from the small size storage position, the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** of the first locking member **42** may bump each other. Further, it is difficult to avoid a collision in consideration of movement in a state where the trailing end regulating lever **61** is thrown as well as a disadvantage in component precision or a gap between the components.

In addition, in a state where the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** of the first locking member **42** bump each other, if the operation portion **62** of the trailing end regulating lever **61** is pushed, at the positions other than the set position, the first and second cams **63** and **64** may push the first and second locking cams **46** and **47** and push the first and second locking cams **46** and **47** in a downward direction.

In this case, as the first locking member **42** rocks, the first and second tooth rows **48** and **49** are separated from the first and second rack tooth rows **34** and **35** of the cassette case **3**, and the state of the first trailing end regulating member **4** with respect to the cassette case **3** becomes a released state. In this state, if the trailing end regulating lever **61** is pushed, at the positions other than the set position, the first and second cams **63** and **64** may push the first and second locking cams **46** and **47** in both a downward direction and a backward direction.

As a result, before the second trailing end regulating member **5** reaches the A5 storage position, the first trailing end regulating member **4** may move in a large size storage direction. In addition, if the situation is generated, the first trailing end regulating member **4** and the second trailing end regulating member **5** may not be integrated with each other at the A5 size storage position.

For this reason, in this embodiment, when the first trailing end regulating member **4** is moved, the first trailing end regulating member **4** is elastically engaged with the cassette case **3**, and the first trailing end regulating member **4** and the

second trailing end regulating member **5** are integrated with each other, using a click member that applies a sense of click to the user.

In this case, when the first trailing end regulating member **4** is moved, as a member that applies a sense of click to the user, a trailing end click member **44** is provided as illustrated in FIG. **7**, in this embodiment.

The trailing end click member **44** is used to apply a sense of click to the user, when the first trailing end regulating member **4** is moved to a storage position (trailing end regulation position) of a sheet having a standardized size. The trailing end click member **44** is restricted to the first trailing end regulating member **4** in a forward-to-backward direction. In addition, the trailing end click member **44** is mounted to move in an upward-to-backward direction. A trailing end click spring **45** pushes the trailing end click member **44** in a downward direction.

Further, in order to make the first trailing end regulating member **4** accurately held at the storage position of the sheet having the standardized size, as illustrated in FIG. **8**, a plurality of concave portions **44***a*, each of which has a V shape corresponding to the V shape of the lower end of the trailing end click member **44**, are formed in the cassette case **3**. As such, the V shape of the lower end of the trailing end click member **44** and the concave portions on the cassette case side are engaged with each other and the first trailing end regulating member **4** is moved from the large size storage position to the A5 storage position, a sense of click can be applied to the user when the sheet having the standardized size is stored.

Meanwhile, when the sheet having the small size is stored, only the second trailing end regulating member **5** is moved. However, when the second trailing end regulating member is moved and the sheet having the standardized size is stored, the same sense of click is applied. For this reason, this embodiment uses the V shape of the lower end of the third locking member **54**. As illustrated in FIG. **16**, the concave portion **38***a* having the V shape that corresponds to the V shape of the lower end of the third locking member **54** is formed on the third locking releasing rib **38** of the cassette case **3**.

In this case, when the second trailing end regulating member **5** is moved from the small size storage position to the A5 storage position, in order to prevent the first and second cams **63** and **64** and the first and second locking cams **46** and **47** from bumping each other, a sense of click of the first trailing end regulating member **4** at the A5 storage position is increased. For this reason, among the plurality of concave portions that are formed at the side of the cassette case, the shape of the concave portion that is engaged with the trailing end click member **44** at the A5 storage position is set to be different from the shapes of the other concave portions, thereby increasing resistance. In this way, it is possible to make the movement of the first trailing end regulating member **4** from the A5 storage position to the cassette case **3** difficult.

The engagement operation of the trailing end click member **44** is independent on the operation of the trailing end regulating member **61**, and is performed even though engagement of the first and second tooth rows **48** and **49** of the first locking member **42** of the first trailing end regulating member **4** and the first and second rack tooth rows **34** and **35** of the cassette case **3** is released. For this reason, even though the first and second cams **63** and **64** and the first and second locking cams **46** and **47** bump each other, if the trailing end click member **44** is used, it is possible to make the first trailing end regulating member **4** not move from the A5 storage position. If the first trailing end regulating member **4** is not moved, the first and second trailing end regulating members **4** and **5** can be integrated by pushing the trailing end regulating lever **61**.

In this embodiment, in order to integrate the first and second trailing end regulating members **4** and **5** with each other, as illustrated in FIG. **17**, an angle of when the first and second cams **63** and **64** and the first and second locking cams **46** and **47** bump each other is decreased (with respect to a horizontal direction).

In this case, if the angle of when the first and second cams **63** and **64** and the first and second locking cams **46** and **47** bump each other is increased with respect to the horizontal direction, the first and second cams **63** and **64** may simultaneously push the first and second locking cams **46** and **47** in both a downward direction and a backward direction, when the first and second cams and the first and second locking cams bump each other. In this case, the first and second tooth rows **48** and **49** of the first locking member **42** are separated from the first and second rack tooth rows **34** and **35** of the cassette case **3**. Further, the first trailing end regulating member **4** may be pushed in a backward direction, and the first trailing end regulating member **4** may move to the cassette case **3**.

Accordingly, in order to prevent the first trailing end regulating member **4** from moving, an angle of when the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** bump each other is decreased. In this configuration, when the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** bump each other, the first and second cams **63** and **64** may push the first and second locking cams **46** and **47** in a downward direction. For this reason, the first and second tooth rows **48** and **49** of the first locking member **42** are separated from the first and second rack tooth rows **34** and **35** of the cassette case **3**.

However, even though the first trailing end regulating member **4** is pushed in a backward direction, since the angle of when the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** bump each other is decreased, resistance is decreased. At this time, since the resistance is smaller than the resistance by the trailing end click member **44** at the A5 storage position of the above-described first trailing end regulating member **4**, it is possible to make the movement of the first trailing end regulating member **4** from the A5 storage position to the cassette case **3** difficult.

Further, decreasing the angle of when the first and second cams **63** and **64** and the first and second locking cams **46** and **47** bump each other may be difficult from a relationship between first and second tooth rows **48** and **49** of the first locking member **42** and the first and second rack tooth rows **34** and **35** of the cassette case **3** in the separation amount.

For this reason, in this embodiment, as illustrated in FIG. **17**, the second cam **64** and the first locking cam **46** are formed to have asymmetrical shapes at the left and right sides in a width-wise direction. In this case, the side end of the second cam **64** is used as a first cam portion **73** and the center side thereof is used as a second cam portion **74**. Further, the side end of the first locking cam **46** is used as a first locking cam portion **75** and the center side thereof is used as a second locking cam portion **76**. Further, the second cam portion **74** has a shape that is escaped from the first cam portion **73**, and the first locking cam portion **75** has a shape that is escaped from the second locking cam portion **76**.

FIG. **17** illustrates a state of when the trailing end regulating lever **61** is thrown in a d direction and the second trailing end regulating member **5** is moved from a small size storage position to an A5 storage position. At this time, as illustrated

in FIG. **17**, since the second cam portion **74** of the second cam **64** of the trailing end regulating lever **61** has an escaped shape, it is possible to decrease an angle of when the second cam portion of the second cam of the trailing end regulating lever and the cam shape of the second locking cam portion **76** of the first locking cam **46** bump each other. Alternatively, the bumping can be avoided. Further, since the first locking cam portion **75** of the first locking cam **46** has an escaped shape, it is possible to decrease the angle of when the second cam **64** and the cam shape of the first cam portion **73** bump each other or avoid the bumping.

As such, even though the cam shapes are asymmetrical shapes at the left and right sides and the escaped shape is added, the shapes of the first cam portion **73** of the second cam **64** and the second locking cam **47** of the first locking member **42**, and the shapes of the first cam **63** and the second locking cam portion **76** of the first locking cam **46** are the same as the shapes described above. For this reason, when the first trailing end regulating member **4** and the second trailing end regulating member **5** are integrated with each other, the cam relationship is not collapsed, and the normal operation is enabled.

Meanwhile, when the trailing end regulating lever **61** is thrown in a c direction and the second trailing end regulating member **5** is moved from the small size storage position to the A5 storage position, the angle of when the first and second cams **63** and **64** of the trailing end regulating lever **61** and the first and second locking cams **46** and **47** bump each other is decreased. For this reason, it becomes difficult for the first trailing end regulating member **4** to move from the A5 storage position to the cassette case **3**.

As described above, since the second cam **64** and the first locking cam **46** have asymmetrical cam shapes at the left and right sides in a width-wise direction, the first trailing end regulating member **4** and the second trailing end regulating member **5** can be smoothly integrated with each other.

Meanwhile, in this embodiment, the body **4**A of the first trailing end regulating member **4** and the body **51** of the second trailing end regulating member **5** are provided with bump surfaces **4A1** and **5A1** that bump the sheet at the time of storing the sheet illustrated in FIG. **2**. In addition, in the storage state of the small size sheet where the first and second trailing end regulating members **4** and **5** are separated from each other, the trailing end of the sheet bumps only the bump surface **5A1** of the second trailing end regulating member **5** that bumps the sheet.

However, in the storage state of the large size sheet including the sheet having the A5 size where the first and second trailing end regulating members **4** and **5** are integrated with each other, the second trailing end regulating member **5** is disposed such that the bump surface **5A1** thereof is escaped from the trailing end of the sheet from the bump surface **4A1** of the first trailing end regulating member **4**. As a result, the trailing end of the sheet bumps only the bump surface **4A1** of the first trailing end regulating member **4**.

By this configuration, in the case of the large size sheet, the bump surface **4A1** of the first trailing end regulating member **4** whose width length is longer than that of the second trailing end regulating member **5** can actively bump the trailing end of the sheet. As a result, it is possible to remove the deviation of the storage position of the sheet, that is, the inclination or the deviation from the sheet feeding direction, which results in preventing skew feeding at the time of feeding the sheet.

As described above, according to this embodiment, the user operates one trailing end regulating lever **61**, thereby releasing holding of the trailing end regulation positions of the first and second trailing end regulating members **4** and **5** and moving the first and second trailing end regulating members **4** and **5** to the trailing end regulation positions according to the size of the stored sheet. As a result, it is possible to improve usability.

Next, a second embodiment of the present invention will be described.

FIG. **18** is a diagram illustrating the configuration of a sheet cassette provided in an image forming apparatus including a sheet feeding apparatus according to this embodiment. Further, in FIG. **18**, the same components as those in FIG. **11** are denoted by the same reference numerals.

In this embodiment, in order to increase the sheet storage capacity of the sheet cassette **2**, the heights of the first and second trailing end regulating members **4** and **5** are increased. As such, if the height of the second trailing end regulating member **5** is increased, the position of the rotation center of the trailing end regulating lever **61** becomes higher. If the position of the rotation center of the trailing end regulating lever **61** becomes higher, a rotation angle is decreased, even though the trailing end regulating lever **61** is operated.

As a result, the configuration where the first cam **63** and the second cam **64** that are provided in the trailing end regulating lever **61** push the first locking cam **46** and the second locking cam **47** of the first locking member **42** corresponding to the first cam **63** and the second cam **64** may not be proper. As a result, it may not possible to release locking of the first trailing end regulating member **4**.

Accordingly, in this embodiment, as illustrated in FIG. **19**, a fifth locking cam **82** is provided in the first locking member **42** that is rotatably mounted in the first trailing end regulating member **4**. Further, a link cam member **83** is provided in the second trailing end regulating member **5** to move in an upward-to-downward direction. The link cam member **83** serves as a link member that is located between the trailing end regulating lever **61** and the first locking member **42** and transmits the operation of the trailing end regulating lever **61** to the first locking member **42**.

In this case, the link cam member **83** has a first link cam **84** and a second link cam **85** that correspond to the first cam **81** of the trailing end regulating lever **61**. Further, the link cam member **83** has a third link cam **86** that corresponds to the first locking cam **82** of the first locking member **42**.

In addition, as illustrated in FIG. **20**, if the user throws the operation portion **62** of the trailing end regulating lever **61** in a c direction, since the first cam **81** provided in the trailing end regulating lever **61** rotates and pushes in the second link cam **85**, the link cam member **83** moves in a downward direction. As a result, the third link cam **86** pushes the first locking cam **82**.

As illustrated in FIG. **21**, similar to the above case, if the user throws the operation portion **62** of the trailing end regulating lever **61** in a d direction, since the first cam **81** provided in the trailing end regulating lever **61** rotates and pushes in the first link cam **84**, the link cam member **83** moves in a downward direction. As a result, the third link cam **86** pushes the first locking cam **82**.

As a result, even in the case where the link cam member **83** is used, it is possible to release locking of the first trailing end regulating member **4** with respect to the cassette case **3** by the first locking member **42**, regardless of whether the user throws the operation portion **62** of the trailing end regulating lever **61** in a c direction or a d direction.

As in this embodiment, if the link cam member **83** is used, by the operation of the trailing end regulating lever **61**, holding of the trailing end regulation positions of the first and second trailing end regulating members **4** and **5** can be released and the first and second trailing end regulating members **4** and **5** can be moved to the trailing end regulation

positions according to the size of the stored sheet. As a result, in order to store the large amount of sheets, the sheet stacking height is increased. Accordingly, even when the height of the second trailing end regulating member **5** is increased, it is possible to improve usability.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

What is claimed is:

1. An image forming apparatus, comprising:

a sheet cassette;

a sheet feeding apparatus configured to feed a sheet stored in the sheet cassette; and

an image forming portion configured to form an image on the sheet transmitted by the sheet feeding apparatus,

wherein the sheet cassette includes:

a cassette body configured to store the sheet,

a first regulating member that is provided in the cassette body, is configured to be slid in a forward-to-backward direction, and is configured to regulate a trailing end of the sheet stored in the cassette body,

a second regulating member that is provided in the first regulating member, is configured to be slid in a forward-to-backward direction, and is configured to regulate the trailing end of the sheet stored in the cassette body,

a first holding portion that engages a first engagement unit provided in the cassette body and is configured to hold the first regulating member and the cassette body,

a second holding portion that engages a second engagement unit provided in the first regulating member and is configured to hold the first regulating member and the second regulating member,

a releasing portion that includes a single operation lever that is configured to release both holding of the first holding portion and holding of the second holding portion in response to an operation of the operation lever,

a connecting portion configured to connect the first regulating member and the second regulating member for integral movement, and

a connection releasing member configured to release a connection of the first regulating member and the second regulating member,

wherein, in a connected state of the connecting portion, the releasing portion is configured to release holding of the first holding portion by the operation of the operation lever, and

wherein, in a released state of the connection releasing member, the releasing portion is configured to release holding of the second holding portion by the operation of the operation lever.

2. The image forming apparatus according to claim **1**,

wherein the releasing portion includes:

a first holding releasing portion configured to release holding of the first regulating member by the first holding portion, and

a second holding releasing portion configured to release holding of the second regulating member by the second holding portion.

3. The image forming apparatus according to claim **2**,

wherein each of the first holding releasing portion and the second holding releasing portion of the releasing portion includes two cam portions that are provided along a sheet feeding direction, and

the two cam portions of each of the first holding releasing portion and the second holding releasing portion are provided at positions that enable holding of the first regulating member and the second regulating member to be simultaneously released.

4. The image forming apparatus according to claim **1**,

wherein the connection releasing member is configured to release the connection of the connecting portion such that only the second regulating member is slid, when the trailing end of the sheet having a size smaller than a predetermined size is regulated.

5. The image forming apparatus according to claim **4**,

wherein the connecting portion includes an inserting portion having a protrusion shape that is configured to be provided in the second regulating member and a slit portion that is configured to be provided in the first regulating member and have the inserting portion inserted therein, and

the connecting portion is configured to connect the first regulating member and the second regulating member by inserting the inserting portion into the slit portion.

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